Editorial

ONE or two readers have intimated that in their opinion I have been somewhat gloomy about the impression television will have on society when it really gets going.

They think I am being too pessimistic in my fears that it will stifle independent opinion and encourage passive acceptance of ideas rather than individual action.

I had hoped to give the impression that I was more fearful than fatalistic— that I was stressing dangers rather than inevitable results.

But it is better to draw attention to such dangers than to commence an outcry when it is too late.

We have every opportunity to handle television in such a way that it will benefit us all. The point is that we just can't afford anything else, for television has the potential ability to build itself into the biggest industry the world has yet seen. So big that it can't be considered merely as a single venture. It will draw into its net dozens of other ventures with which it will become inextricably mixed.

Observers of the world of radio and entertainment are all leaning to the view that no one may be able to afford television unless it is paid for by all. A leading engineer in Sydney said at a recent television demonstration that in his view, the only people who may yet be able to pay for television would be programme sponsors on the largest scale in the largest countries. He doubted, for instance, whether the BBC with all its resources could maintain even one high grade programme indefinitely without outside help. In America, only those sponsors with millions to spend are in a position to support really top-rate programmes.

As I see it, we may yet find that television in the long run will not be able to give us worthwhile material unless it draws extensively on every form of entertainment we have —films, theatres, sporting events, educational resources. It may even be that our television must be the ultimate and largely the only outlet for entertainment, so vast is its consumption of available material. We may find that if programmes are to be maintained on a round-the-clock high level, television will eventually swallow everything else in the effort.

The process may take time, but there is no doubt that such a future lies somewhere in the cards.

We must, therefore, look as far ahead in this matter as it is possible to do. I am sure the man in the street hasn't yet realised what a giant has been born. The time for examination, for thought, and for analysis is now. In so vast an enterprise, we cannot afford to be wise after the event.

John Moyle

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RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

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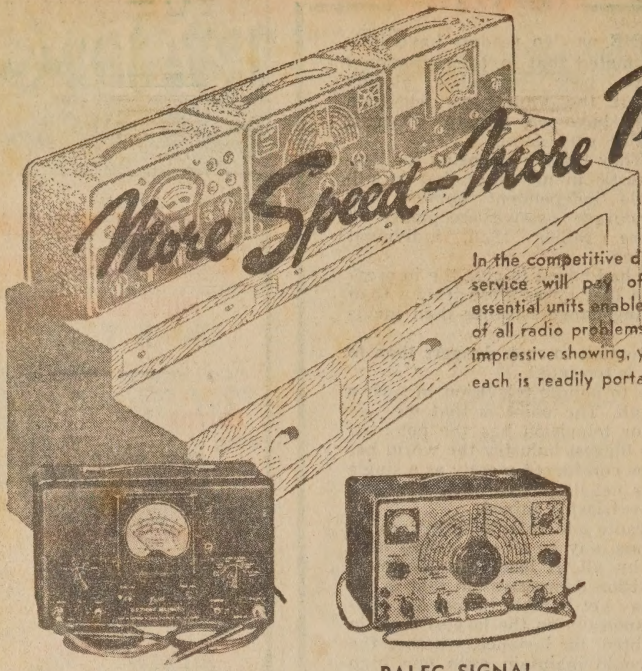

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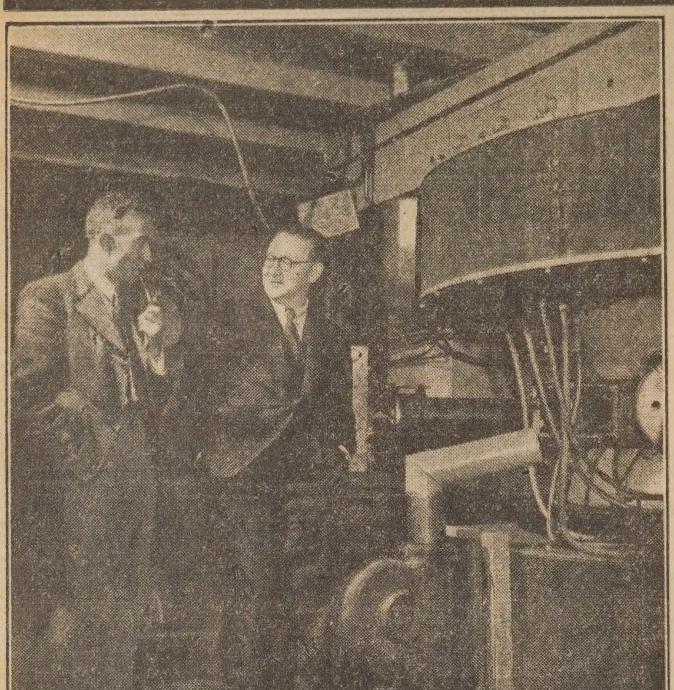
ATOM PILE IN BRITISH RESEARCH

A Van de Graaff generator installed at the Harwell Atomic Energy Research Establishment in Britain. See story on atomic energy on next page.

APPLICATIONS OF ATOMIC ENERGY



Professor Sir John Cockcroft, C.B.E., F.R.S., Director of the Atomic Energy Research Council at Harwell, England, with Dr. A. E. Kempton, in front of a cyclotron at the Cavendish Laboratory.

Nowadays "the atom" has news value, so unfortunately a lot of nonsense is being written about it. We are asked to believe that an era of unlimited power from atomic energy is just around that well-known corner. Of course, no nuclear reactor has yet been run to produce power on a commercial scale nor is it likely to in the near future, although a few pilot models may come into operation within the next five years or so.

By PROFESSOR F. E. SIMON

Professor of Thermodynamics at the University of Oxford.

QUITE apart from the many technical difficulties, every new invention must take many decades before it can really affect our way of life; it simply takes a long time to build all the machinery and other equipment necessary to bring about big changes. What then are really the prospects for the future,

There are in principle two ways of obtaining nuclear energy; although we know that one of these methods is taking place inside the stars, only the so-called fission process has been realised in the laboratory.

By "burning" the rare 235 isotope of uranium in a reactor, or as it is sometimes called a "pile," nuclear energy is transformed into heat and at the same time some of the uranium is changed to plutonium — another nuclear fuel.

So far large piles have only been run to produce plutonium which can be used as an explosive, and the heat energy has been run to waste. Our aim now is to run piles at very high temperatures so that we can efficiently transform the heat energy into, say, electricity.

This involves a great number of difficult questions, which it will take time to solve. Then the whole plant will be highy radioactive and quite unapproachable, so repairs and maintenance work will be very awkward.

It must be also realised that piles must be a certain minimum size, and this is very large for reactors working off natural uranium; in any case all piles must be screened by a protective shield many feet thick. Therefore small units for use in motor cars and so on are quite out of the question; the most probable use of piles will be in biggish power plants when the technical difficulties have been solved, say in a few decades.

COST OF NUCLEAR POWER

Nuclear power plants have many disadvantages and it is still an open question whether it will be really worthwhile to use them on a large scale quite apart from the complication that they all produce plutonium which can be used in bombs. After all, other power sources are available and if nuclear power is to be used, it must be able to compete economically with them.

So far no practical data is available, but it seems probable that after overcoming the usual early troubles power could be provided by nuclear reactors at about the same cost as from ordinary sources.

The main consideration, however, in discussing the future large scale development of nuclear energy is whether there is enough fissile material or "fuel" available.

Although there is a lot of uranium in the earth's crust, over 99 per cent consists of the isotope 238 and most of that is in low grade ores. Large scale development depends on the possibility of making use of these low grade ores and also on using the 238 isotope in the so-called "breeding" process. There are good hopes for both possibilities, but no certainty yet.

The great advantage which nuclear energy offers lies in the light weight of the fuel; this makes it very attractive for certain special jobs: for providing power in out of the way places—perhaps to irrigate deserts and very probably for the propulsion of large ships. It seems certain that the next ten or 20 years will see nuclear power plants of this type in operation, but it is still not possible to say definitely that by the end of the 20th century nuclear energy will be providing quantities of power comparable to those from other sources.

GREAT VALUE OF ISOTOPES

The picture would be quite different if we could find a practical process to build up heavier elements from light ones, in particular to combine hydrogen nuclei to form helium as is done in the stars.

At the present moment no way of doing this in a controllable reaction

can be seen, though there are "good" chances that it can be used to produce the hydrogen bomb. There is, however, no reason why we should not find some way say within the next 50 or 100 years. In this case the so-called thermo-nuclear reactions would, together with solar energy, probably be the main source of power in the distant future when supplies of conventional fuel and of uranium have given out.

Although nuclear research has not yet provided us with any power it has already given us isotopes which are of outstanding value, particularly in medical research and in industry. These isotopes are produced in piles and are like normal atoms save that they also carry a "radio transmitter" which enables us to locate them very easily.

Thus it is possible to study the part that different kinds of atoms play in say biological and industrial processes. It should also be realised that these isotopes can be obtained from piles so small that there is no danger of misuse.

As much of what has appeared in the popular press on atomic energy has been misleading I am glad that a really good introduction to the subject for the interested layman has been produced. Titled "Atomic Energy," this book will give a sound picture of the present position to anyone who is prepared to concentrate his thoughts for a few hours. (Penguin edition.)

USEFUL BOOK

A study of this book should help the layman to understand why it is so important that research on nuclear energy should continue on a large scale. While other essential fields of development should not be neglected, nucelar research should be fostered up to the limits set by economic means and the availability of scientific manpower. The position is not unlike that in the story of the man who left a vineyard to his sons and told them that there was a treasure hidden in it. The sons dug up the place furiously without finding any, but owing to the work put into the soil they were recompensed by excellent harvests. It is quite certain that nuclear research will yield good returns, although perhaps not in a field which most people are envisaging at the present moment, but it is also certain that much hard work will have to be put into it.

CAST WHOLE AEROPLANE WINGS

PRACTICABILITY of casting entire aeroplane wings of magnesium alloy will be determined by Northrop Aircraft, Inc. The outer half of a wing will be cast in one piece. Tests will then compare its characteristics with a similar wing made from aluminium sheet and extrusions by conventional fabrication methods. If the project is successful, less time and equipment will be needed to expand production of the cast structures than would be needed for riveted structures.

PRODUCING THE FORGOTTEN ELEMENTS

By ALDEN P. ARMAGNAC

Out of a battery of glass tubes in an American laboratory in the mid-western State of Iowa come strange metals, some of the most precious on earth. Their unusual properties may prove vital to the atomic age. They once were rarer than diamonds and actually priceless. Even now, being produced in pound lots by a method born of the United States Atomic Energy Research, they cost up to 31 times their weight in gold.

FEW people have ever seen them. Grey to light grey in color with a high metallic lustre at first, they turn odd shades on exposure to air —pale yellow, cream color, black, greyish pink. Their compounds vie in brilliant hues with the colors of the rainbow.

Called the "rare-earth" metals, they are true chemical elements, just as iron, copper, and silver are. Their names sound like something out of an apothecary shop — lanthanum, cerium, praseodymium, neodymium, to mention a few.

The whole group of 15 rare-earth metals might well be called the "forgotten elements." They make up nearly one-sixth of the 96 known elements, the basic materials of which all things are made. Yet a typical college textbook on chemistry, more than 1000 pages long, devotes a scant two pages to them.

TYPICAL USES

Practical uses of rare-earth metals have been as few in proportion. Just one may be familiar to most laymen. Spin the wheel of a cigarette lighter, and you are striking fire from pyrophoric, or spark-producing, rare earths, cerium metal in particular, in the alloy of the flint. Anthanum, oxide goes into special optical glass for aerial-camera lenses. Neodymium oxide absorbs glare in glass-blowers' goggles. Carbon-arc projectors in motion picture theatres give an intense white light because of rare earths in the carbons. There have been a few other uses for rare earths, but not many.

Today, however, these forgotten elements have become news in the United States. Atomic research has drawn attention to them. Under the direction of Dr. Frank H. Spedding, chemist at Iowa State College, the Ames Laboratory of the US Atomic Energy Commission has begun producing highly purified rare-earth metals and compounds in unprecedented quantity.

One object is to see if they may be useful materials for future atomic power plants—for instance, in control rods and in lightweight shielding against dangerous radiations from atomic engines of ships and planes. Forming as "ashes" in uranium rods of power-piles, rare earths have been a nuisance, tending to put out the atomic fires by absorbing neutrons. But that very vice would be a virtue in shielding and control.

"Moreover," says the US Atomic Energy Commission, "it now appears that they may have a bright commercial future as alloy metals in the manufacture of high-temperature structural materials."

It is partly the small proportion of rare earths in the earth's crust that makes them "rare," not scarcity of places where they can be found. One widely distributed ore is the yellow-to-brown monazite sand found in the Atlantic coastal States of North and South Carolina, as well as in Brazil, Africa, and India. Norwegian mines furnish gadolinite, a glossy black rare-earth ore, and others. Rare earths of commerce have been relatively inexpensive "concentrates" or crude mixtures obtained from these ores. For example, cerium for cigarette-lighter flints is a commercial alloy known as "misch-metal," consisting of cerium and seven other rare-earth metals, and other impurities.

But one of the chief reasons the rare earths are so "rare" is their unusual chemical resemblance to each other. They are so much alike that ordinary chemical methods cannot separate one from the other. Years of tedious evaporating and redissolving were formerly necessary to get a few specks of material.

Then in early 1944, atomic energy research workers in the United States made the amazing discovery that rare earths formed by uranium fission could be separated—in hours instead of years—simply by passing a solution of them through a vertical tubeful of synthetic resin. Samples were, at first, subvisible "tracer" quantities; later, visible ones of ten-thousandths of an ounce.

MISSING ELEMENT

Exciting news came from laboratories at Oak Ridge in the southern State of Tennessee, when two young chemists separated a mysterious substance from fission-produced neodymium with one of the new resin tubes or "ion-exchange columns." It proved to be the long-missing rare-earth element Number 61, which they named prometheum. Radioactive and short-lived, it is believed non-existent in nature. First visible samples, pink and yellow smears on white porcelain discs, are minute quantities of prometheum nitrate and chloride respectively.

In the meantime, Dr. Spedding, of Iowa State College, proposed a bold step-up in scale. Instead of being content with "micro" quantities of pure rare earths, why not adopt the new method to produce them in "macro" amounts of grams or even pounds? He and his colleagues in-

(Continued on Page 93)

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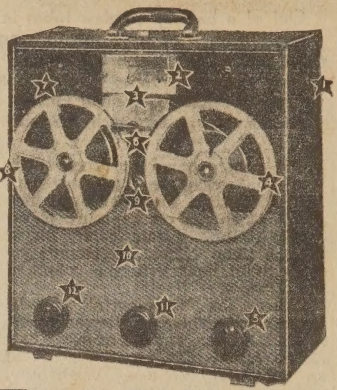

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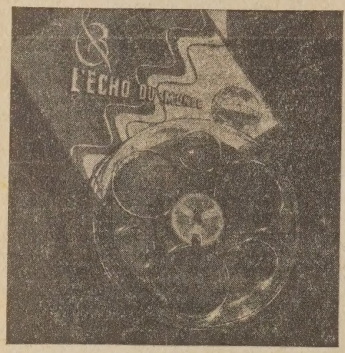

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RADIO 20 YEARS BEFORE MARCONI

One day in 1875 a young chemistry teacher was hustling from room to room of what was then the old Boys' Central High School in Philadelphia, indulging in the queer antic of pointing a pencil at door knobs. Growing more pleased as he paused to point at each knob, the teacher hurried up the wooden staircase to the next floor to continue his ritual.

SOON the deliberations of an astronomer in his sixth floor observatory library were disturbed by an unusual commotion. He found the chemistry teacher pointing his stubby pencil at the knob of the heavy wooden door of the library.

With some excitement the chemist showed the astronomer that a spark jumped from the door knob to his pencil point.

The historical importance of this brass door knob, which is still serving its less astonishing function of opening the door to the library, is told in a plaque on the walls of the old school building, reading:

"Benjamin Frankling High School
Birthplace of Wireless
In This Building in 1875
Elihu Thomson and Edwin Houston,
Young Science Teachers,
Sent and Received Wireless Waves
To the Distance of 100 Feet."

The door-knob experiment in 1875 took place 20 years before the practical application of wireless by Marconi. It preceded by a dozen years the famous experiments of Hertz.

EARLY OBSERVATIONS

The excitement of the discovery of this 22-year-old high school teacher, Prof. Elihu Thomson, whose 97th birthday anniversary will be observed March 29 and who died March 13, 1937, may be judged by the descriptions of how the signals were received first from distances of a few feet in the same room with the sending apparatus, then from different rooms on the same floor, "even though separated by brick walls."

It was an extraordinarily busy young scientist who had the major role in this historical achievement, and the reason why he never followed through his startling discovery to a practical application makes a story in itself.

From breakfast till bedtime he was occupied with his class work, and at the same time he was launching many of the inventions which later made him the holder of more than 700 patents—discoveries which later took him out of the classroom into industry, where he founded the Thomson-Houston Electric Company and later became one of the founders of the General Electric Company.

But the 22-year-old Elihu Thomson certainly was not unaware of the implications in the little sparks between the door knob and the pencil in his hand.

"I realised," he wrote, "that if we had been able to go down the street probably about a quarter of a mile away, the same tests might have been productive of positive results, and I further realised that we had the germ of a new system of electric signalling."

ANOTHER ACCOUNT

The astronomer whose deliberations were interrupted that day in the old Philadelphia school by young Thomson's excited intrusion was Prof. Monroe B. Snyder, later director of the Philadelphia Observatory and known as the originator of the plan to establish a United States Bureau of Standards. He described the event in these words:

"One day in 1875, while busily engaged in the old High School Observatory, at an elevatorless height that usually obviated intrusion, I was surprised by a bustling visit from my associate, Professor Elihu Thomson. He was bent, as I soon found, on testing whether the ether disturbance, which he was exciting by means of a Ruhmkorff coil in the Physical Room of the first floor of the building, could be observed in the Observatory hallway on the sixth floor.

"Applying the sharpened point of a short lead pencil near the brass knob of the library door, Thomson called attention to the delicate sparks that were passing between the pencil point and the door knob.

With due elation over the success of the test, he then told me that he had similarly traced the ether disturbance all through the building; in the Lecture Hall on the first floor at the distance of 60 feet; at the room of the Professor of Mathematics on the third floor at a distance of about 80 feet; and now at the door knob of the Observatory Library, distance perhaps over 100 feet from the experimental apparatus."

MORE SPARKS

Thomson was an apprentice teacher still in his 'teens when he and Professor Edwin J. Houston, the high school's physical science teacher, made their first experiments with a Ruhmkorff coil in 1871. The coil threw a "spark six inches in free air." In their experiments the young scientists sought to increase "the quantity of the spark of the induction coil without greatly diminishing the length." The secondary wires of the coil were connected with a gas pipe and with a wire

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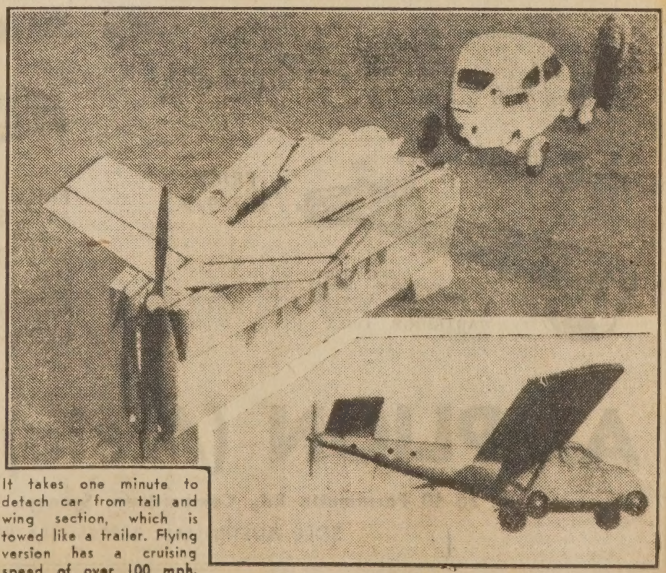

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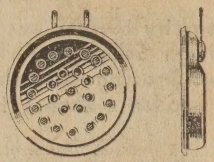

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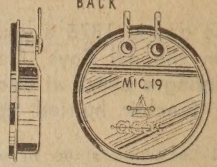

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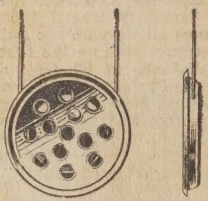

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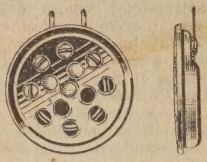

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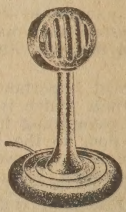

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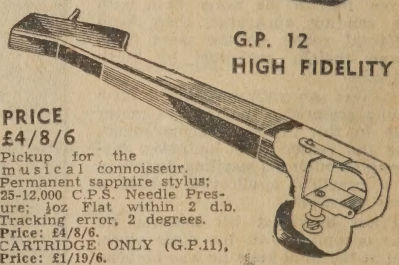

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SOLE AUSTRALIAN REPRESENTATIVES

resting on the lecture table which supported the coil.

Professor Houston wrote that, while electricity was flowing between the points of the coil, "long sparks may be drawn from any metallic article within eight or nine feet of the coil," and "even from a small steam engine, which latter was fully thirty feet from the coil."

It was four years later before anything further was done with the experiment. The new efforts were prompted by an article in the Scientific American in 1875, in which Thomas A. Edison, a young telegraph operator who had won attention with several inventions, reported on similar experiments.

Edison attributed the sparks drawn from surrounding objects to an unknown "etheric force." Thomson and Houston then renewed the experiments which led to the Observatory door knob on the sixth floor. They became convinced, and Professor Snyder, the astronomer, agreed with them that Edison's mysterious "etheric force" was in reality the transmission of electrical impulses through the air without wires.

They had demonstrated the existence of electromagnetic waves which the English physicist, James Clark Maxwell, had advanced theoretically. Maxwell wrote a paper, "On a Dynamic Theory of the Electromagnetic Field," in 1865, and in 1873 in another treatise he suggested that electric action is propagated through space in the form of waves which travel at the speed of light.

Professor Houston, being eight years Thomson's senior, wrote an account of the experiment for the Franklin Institute Journal of May, 1876, and it was reprinted in the Scientific American Supplement. Thomson, however, revealed in later years that he originated the experiments for which Houston received partial credit. It was the younger man who saw that here was "the germ of a new system of electric signalling."

While other duties prevented the experiment being beyond the door knob, Thomson never lost interest in the possibilities he saw for wireless. In 1892—the year in which his Thomson-Houston Electric Company joined with Edison's company to form the General Electric Company—Thomson wrote an article for the New England Magazine which was accompanied by a drawing of a lighthouse sending out electric waves along with light to penetrate a fog.

"Electricians are not without some hope," he said in the article, "that signalling or telegraphing for moderate distance without wires or even through a dense fog may be an accomplished fact soon."

In the following year at the Chicago World's Fair he told Dr. Sylvanus Thompson that wireless was an evident possibility and would take but moderate equipment.

There were many sceptics when, in 1896, the world was told that Marconi had spanned the Atlantic Ocean with wireless. But Professor Thomson was among the first to greet the successful Marconi and to insist upon public appreciation of his achievement.

In the New York Times of February 17, 1939, Dr. Karl T. Compton, president of the Massachusetts Institute of Technology, wrote that he considered Professor Thomson as "anticipating the wireless transmission of signals 12 years before Hertz demonstrated electro-magnetic waves and 20-odd years before Marconi received his patent on 'telegraphy without wires'."

THEY MADE CORROBOREE RECORDS

The men mainly responsible for making the Corroboree recordings reviewed on page 90. Left to right are Mr. Reg. Southey, Recording Studio Manager of HMV., Mr. John Antill, the composer, and Mr. Eugene Goosens, Conductor of the Sydney Symphony Orchestra.

Variable "Micrograde" for long-playing

For some years the Major Gramophone Recording Companies have been endeavouring to increase the playing time on standard size records.

THE Physicist, Eduard Rhein, has developed a system of variable micrograde recordings—also called Compressed Transcription—resulting in a space saving of up to 70 per cent, which space is used either in the increase of playing time or in the improvement of the musical quality of the recording.

To the casual observer the transcribed recording does not vary from the conventional recording in appearance and is playable in the normal way on any record player. However, a microscopic examination of the disc presents an entirely new picture. Whereas the grooves were formerly evenly spaced from one another, irrespective of volume, they are now compressed in such a way that the thickness of the "wall" between each groove is cut to a minimum.

In a musical recording with its constantly changing volume the grooves vary in distance from one another in rhythm with the amount of volume transcribed on to the record. Even the most sudden increase in volume, such as, for instance, a gunshot or a sudden burst of drums will be automatically adjusted in respect of the distance between the grooves. In practice such adjustment is made by the expansion of the groove 1/20th of a second before the increase in volume.

This automatic adjustment of the groove in relation to the recording is the basic novelty of the variable micrograde system.

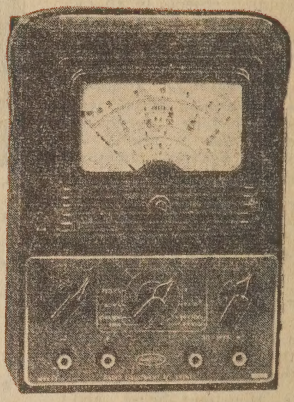
The variable micrograde recording has a further advantage that no attenuation of the lower frequencies would be necessary and thus compensator circuits would be eliminated.

The recording amplifier which adjusts the micrograding contains fifty-six valves. It is a most complicated arrangement which solves the problem of registering electrical impulses and translating these into mechanical functions with a time lag, of great exactitude.

Since the war the Continental Record Industry has changed its system of initial recording to the magnetophone (Plastic Tape) system and then record from the tape on to the wax masters. One variable micrograde recorder can easily manage the conversion of fifty records per day and is being sent by special van from factory to factory, on a hire basis.

TEST EQUIPMENT
FOR
SPEED AND ACCURACY

University



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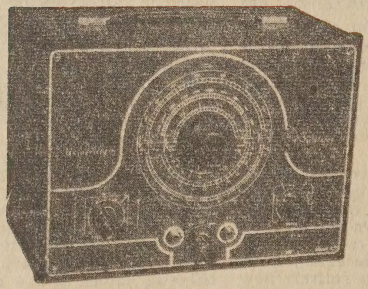
Firmly and sturdily built yet pleasing in appearance, the MVA/2 fills a long-felt want. A.C. and D.C. current ranges can be extended and a leatherette covered Carrying Case is available separately if so desired.



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This fine Oscillator is available either as an A.C. operated Instrument or as a Battery operated Instrument. It has a comprehensive frequency coverage from 160 Kilocycles to 32 Megocycles in five bands. It can be used unmodulated or modulated. The modulation is 30% at 400 cycles. The Dial and Output Control are calibrated and the Instrument is entirely self-contained.

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This handy little Instrument is designed to increase the alternating current range of any suitable Multimeters such as Model MVA/2 above. It allows you to measure A.C. readings as follows:—
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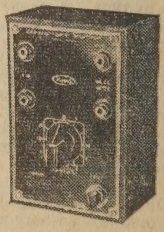

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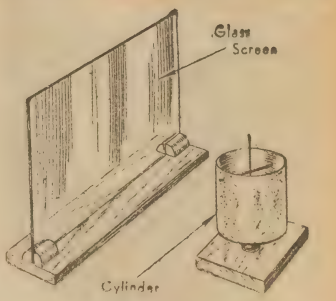
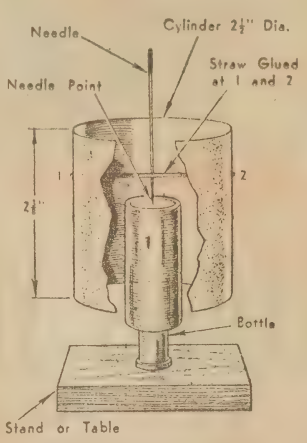
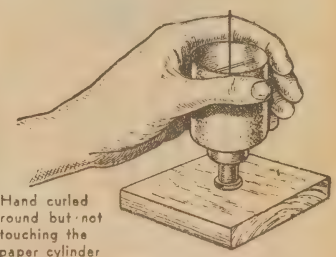
MOTIVE FORCE AND OTHER TOPICS

Some years ago, Air Chief Marshal Lord Dowding made a few tentative suggestions about a possible new motive power. It is, indeed, relatively simple to demonstrate some phenomena which are difficult to explain by the common laws of physics.







A simple experiment for demonstrating the action of "a new motive force."

TAKE a piece of ordinary fairly stiff writing paper and make the little cylinder which I have illustrated.

It is a good plan to cut down both sides so that the joins will balance. Place this queer apparatus on the table where there is no draught of any kind, and then put your right hand ROUND the cylinder, but not touching its surface.

It is many oranges to a dry coconut that the cylinder will revolve just as if your fingers had some emanation which blew against the surface.

It is, by the way, useful to perforate the cylinder from the inside before rolling it up. Use a blunt pin so that the outer surface has a slight roughness.

STILL REVOLVES

If you put a shield against the cylinder as shown in my sketch, the cylinder will again revolve. What is more, if you enclose the whole affair in, for example, a cellophane box, it seems still to revolve, but if the shield is made of metal or glass, rotation can sometimes be stopped.

It appears to make a difference whether you sit facing the north or facing the south, different hands affect the direction of rotation, and there are innumerable experiments which can be made, all of which leave you with the great question, why on earth does the cylinder move at all?

Lord Dowding went to the length of making an artificial hand heated by hot water in order to check the existence or otherwise of human emanations.

WHAT'S THE ANSWER

I well know that there are such things as electrostatic effects, convection and other things, but I think you will not find it so easy to give, as I suggest you do, your explanation.

I think I know how it works, but that does not matter. It remains one of the most quaintly magical devices in existence. Try it.

Once more I see the account of some clever man who has designed a flapping-wing aeroplane, and he has suggested that before long he will fly it by means of human power.

I believe that the ornithopter enthusiasts are wrong, and that they have been influenced by watching birds with less skill at their disposal than that of the famous Alliott Verdon-Roe.

It is remarkably difficult to imitate nature. Inventors often design queer-shaped cranks to increase the "power" of a cyclist, quite forgetting that a human being cannot put out any great exertion for long, even if the necessary mechanism is available. So it is with wing-flapping.

A little observation will show us that the bird has an enormous power-weight ratio, and that if a man was to fly in like fashion he would need the strong, hollow limbs possessed by a bird, not to mention strong arms with "muscles" about 10 inches thick, before any good could be done.

Yet again is this question of comfort an important part of efficiency.

by Professor A. M. Low

We all know the old case of the motor car where people pay £2000 to secure comfort, when £400 will carry them along the road with the same, or even greater, mechanical efficiency.

High-speed photographs of birds, and even the human eye, will show that as the wings move downwards in their screw-like path, reaction humps the bird's body up and down in a way that would soon make you and me feel very queasy.

Copying nature is a thankless task. Cars with feet have often been designed, but wheels are rather more modern.

In the happy days when one drove in expensive motor cars past beautiful houses surrounded by wooden palisades, did you ever notice that a recurring swish suggested a leaking tyre or a stone caught in the tread?

This is the reflection of wheel noise or that of the bow wave of air which is pushed in front of the car. Wooden fencings are usually laid with the direction of the palings changed every 10 yards or so, and the reflection note varies with the position of the edges of the wood stages.

Notice it next time! Very reminiscent of radiolocation if sound be substituted for the movement of electrons.

AIR CURRENTS

Talking of bow waves, you will also find that when butterflies hover in front of a car they are quite commonly snatched away, and carried overhead as the bonnet reaches them.

The cover of air does the trick. It is the skin friction of the air which causes it to be carried along beside the car, and that is why, when you throw a cigarette negligently through the window, it seems to stand still for a moment before vanishing backwards.

Travelling is greatly interesting in all these ways. Watch a train with

(Continued on Page 96)

There's money in a nose! Australia's Mo, the Paris model and American "Schnozzle" Durante are here to prove the statement.

NOBODY KNOWS YOUR NOSE

The sense of smell, though somewhat dimished in modern man, remains as one of the vital links between a man and his surroundings. Strangely enough, scientists are still not agreed as to how the sense of smell really functions.

by Calvin Walters

DESPITE an enormous amount of research the mechanism of the sense of smell remains one of the greatest of mysteries.

This must appear to be a somewhat negative statement with which to begin an article dealing with this remarkable sense. It is, however the plain truth and, if it were not for the purpose of bringing attention to some theories regarding the matter, such an article as this could do no more than restate what has already been written hundreds of times.

The theories of the mechanism of smell are most interesting, although none of them have been wholly accepted by the scientific world.

Before discussing these theories it is important to detail a little of the known anatomy of the sense of smell or the "olfactory" sense as it is called.

VARIED USES

Strangely enough we are not immediately concerned with the nose or nostrils which are used mainly for breathing, blowing and snoring. However, the nose is the repository for the sensitive receptor organs of the olfactory sense and the intake of air through the nostrils is essential for smelling purposes.

We are concerned most of all with the apparatus high up in the nasal organ and which constitutes the olfactory sense proper.

When we consider that the olfactory sense is capable of receiving and identifying possibly some hundreds of thousands of different smells it must be apparent to all that this sense is one of great delicacy and intricacy.

The lower portion of the nose is lined with a membrane called the mucous membrane and the passage through the nostrils is similar in lining to the windpipe.

The membrane contains glands which secrete mucus. Main purpose for this is to trap dust, microbes, insects, etc. The upper cavity of the nose is different from the lower in that it is lined with a membrane of a brownish color, due to a pigment called melanin.

The cells composing this membrane are quite different from the cells in the lower part of the nose.

There are three main types of cells. Those at the surface are shaped somewhat like a spire with the point away from the surface. These are the supporting cells for the sensory cells which are embedded between them.

The sensory cells are shaped li a spindle and from each one the emerges a very thin microscop sized rod which opens out in several fibres and emerges at t surface of the sensory membra mentioned above. These fibres a sensitive to odours which, comi into contact with them stimulate t olfactory nerve.

There is another type of c called basal cells which appear be undeveloped supporting cells a constitute a reserve stock for r placement of damaged supporti cells.

BOWMAN GLANDS

One layer of the mucous me brane consists of glands—the glan of Bowman. These secrete t mucuous which covers the me brane and it is believed that t sole purpose of this mucus is act as a solvent of odourous particle

Nerve fibres are incorporated the projecting rods of the senso cells. These are connected to structure called the olfactory bu which is situated above the muc membrane and separated by a bo structure called the cribiform pla

This olfactory bulb is connect with the brain by means of a fibro structure called the olfactory tra

The olfactory bulb is a remar able piece of apparatus in that also acts as an amplifier for the ve

eak impulses set up on stimulation the nerve.

That such an amplification system necessary is apparent when it is nsidered that three one-hundred-illionth parts of a grain of musk readily detectable by the olfactory echanism.

This amplification is believed to e brought about in the olfactory ulb by means of the large number f granule cells present. One type f granule cell which is less numer-as that the others receives the im-ulses. These are passed on to a econd type of granule cell which more numerous than the first.

AMPLIFIES" PULSES

Each of these are stimulated in rn, thus amplifying the impulse. t collects into one larger impulse, s it were, and passes back to the rst type considerably augmented. hen on to the brain where it is ecoded into a conscious reaction as ich and such a fragrance.

This, then, constitutes the anatomy f the olfactory sense. We do not now, among a lot of other things, hy the brain regards some odors as leasant and others as objectionable.

The explanation of this probably ies in the tendency of nature to ssue warnings in the face of danger o the living body. As we live by ood, it is noteworthy that food and rink which are unfit for consump-ion usually has the characteristic dour of putrifaction.

In recent years there have been ver a score of theories put forward y investigators to account for the ense of smell. At the present time here are three theories which leserve further investigation. Each f these has some feasibility.

The first to be considered is the "Physical theory" of Heyninx.

This investigator states that all dourous substances emit radiations f varying wavelength having a high requency. Each substance has its wn particular wavelength and ransmits energy to the receptor ells of the olfactory mechanism. Here the pigment granules are so rranged that they vibrate in sym-athy with the incoming signal. In ther words the granules are tuned ike a radio receiver. Differences in dour are due to the differences in wavelength.

WEIGHT UNAFFECTED

In support of this theory some investigators showed that some dourous substances gave off odor for many years without appreciable oss of weight. Such a substance is musk.

Further support is lent by the fact hat, in the gaseous state, certain dourous substances show absorption bands in the ultra-violet region of the spectrum while non-odourous substances have the absorption bands outside this range.

According to Heyninx the pigment granules in the receptor cells have diameters corresponding to the wave-lengths of odourous substances.

In most Albinos the pigment granules are absent in the olfactory membrane. When this is the case the person has no sense of smell or to use the techincal term he is "anosmatic." One case at least is recorded of a Negro turning white and at the same time losing his sense of smell.

This theory of Heyninx at least has some support and is at present the subject of further investigation in America.

The next theory to consider is somewhat more complicated and a little difficult to state in comprehensible terms.

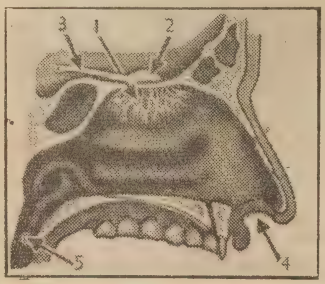
I will attempt to state the theory as simply as possible but it will probably be necessary to read it very carefully and possibly several times.

It is called the "Electrochemical" theory and was put forward by an investigator named Pauling.

ANOTHER THEORY

Pauling states that the energy involved in the stimulation of the receptor cells comes electrochemically from the odourous substance.

In any molecule the electrons are arranged in patterns and the energy of the molecule is partly linked with the electrons of the atoms of the molecule.



Showing the nerves of the nose. 1, branches from the nerve of smell (or olfactory nerve); 2, olfactory bulb connected to the brain; 3, connection to the brain (olfactory tract); 4, air passage; 5, throat.

When a molecule consists of three or more atoms the electrons are thought to exist as patterns of angles called bonding angles between the atoms.

These angles are capable of modification so that when an odourous substance enters the olfactory area it is taken into solution in the olfactory membrane with a consequent alteration in the bonding angles between the atoms. This brings about a rearrangement of the electrons and thus an alteration in vibrational energy.

This alteration in vibrational energy brings about a state of unbalance in the electrostatic fields within the membrane cells and the voltage difference so produced affects the olfactory receptor cells which are provided for that purpose.

INFINITE VARIETY

Because the bonding angles are capable of an infinite degree of change the vibrational energy of the molecule is also capable of infinite variation.

According to this theory any molecule which has the same shape as say a molecule of musk, will smell like musk although chemically the two are quite unrelated.

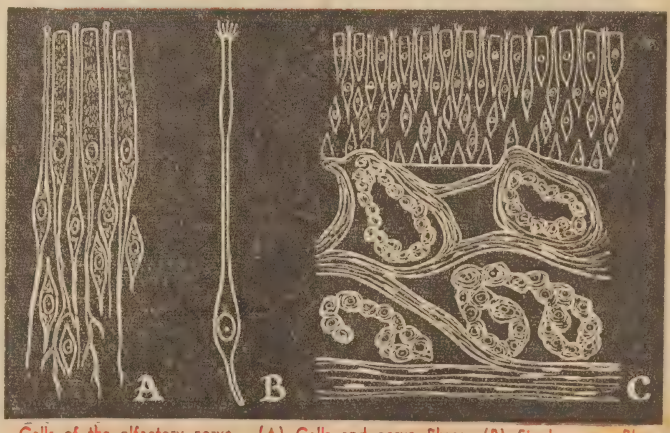
Perhaps this theory could account for the similarity in the smells of synthetic perfumes and the genuine article.

It is certainly a fact that it is necessary to bring about solution of an odourous substance on the olfactory membrane before odour is detectable.

With this theory in mind it follows that a non-odourous substance is one which has no bonding angles, (2) it has an energy value for which no corresponding receptor cell exists and (3) it is one which cannot be brought into solution in the mucous membrane.

This theory does not explain why some odourous substances in low concentration smell differently from

(Continued on Page 19)



Cells of the olfactory nerve. (A) Cells and nerve fibres; (B) Single nerve fibre enlarged; (C) Section of olfactory mucous membrane showing nerve fibres. These cells are in the upper part of the nose.

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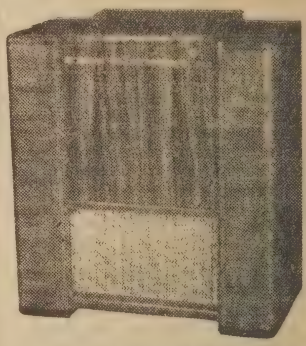

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Technical Review

NEW LIGHT THROWN ON V.H.F. PROPAGATION

Recent DX reception on the 50 mc. amateur band has caused much discussion as to its origin. Favored theories include: (1) Sporadic E reflections (2) temperature inversion effects and (3) normal MUF expectations.

WHILE DX conditions may, in the ultimate, involve a number of different factors, a recent paper published by Bennington and Morris in Wireless World indicates that reception in the 40-50 Mc. region does indeed correspond closely with M.U.F. (maximum usable frequency) predictions.

Regular observations have been made over about 18 months, covering reception of the BBC television sound channel at the Panorama receiving station of the South Africa Broadcasting Corporation. This is situated near Johannesburg and the channel frequency is 41.5 Mc.

Though a full record was kept of the signal quality, the interest was mainly in carrier strength, which was plotted in terms of 0-5 and covering the strongest signal received each day. The observations were plotted as vertical lines on the time scale and the result appears in the upper section of figure 1.

The lower section of figure 1 indicates the number of times in each month reception was noted, expressed as a percentage of the number of observations made.

Figure 1 shows very clearly the seasonal nature of the reception. It was most frequent over the particular parth in the early spring and late autumn, with occasional winter reception and little or nothing in the summer months.

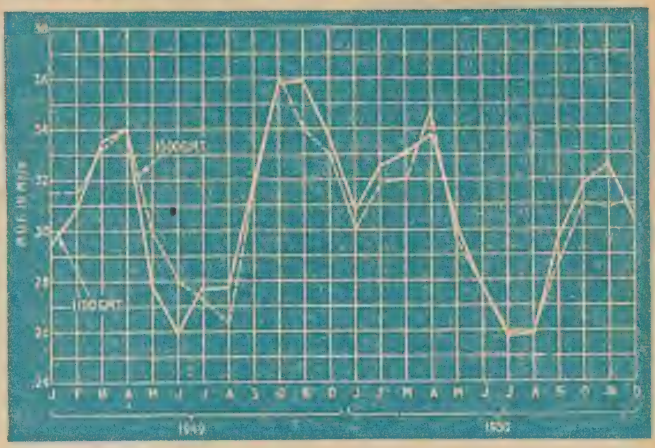

Figure 2. Predicted monthly M.U.F.'s for the Daventry/Johannesburg paths at 1100 and 1500 hours G.M.T. during 1949 and 1950.

Reception during the early spring of 1950 was less frequent than in the corresponding period of 1949, corresponding with reduced solar activity and less ionisation of the F2 layer. Similar observations can be made about other periods.

These results could not be compared in detail with published prediction charts, because such did not exist, nor did the data necessary to compile them. However, a chart for the predicted mean monthly M.U.F. is shown as figure 2, and, although the mean figure is at all times much lower than 41.5 Mc., it must be remembered that the mean is subject to considerable variation over the period of a month.

At all times the general trend of the M.U.F. corresponds with observed results on the London Panorama link.

THE AUTHORS CONCLUDE:

"The seasonal variation thus disclosed is in exact accordance with the expected variation of M.U.F over the path, as indicated by the predicted M.U.F. values. There is strong evidence, however, that the predicted M.U.F.'s for the path were somewhat lower than the actual frequencies, at least during the equinoxes.

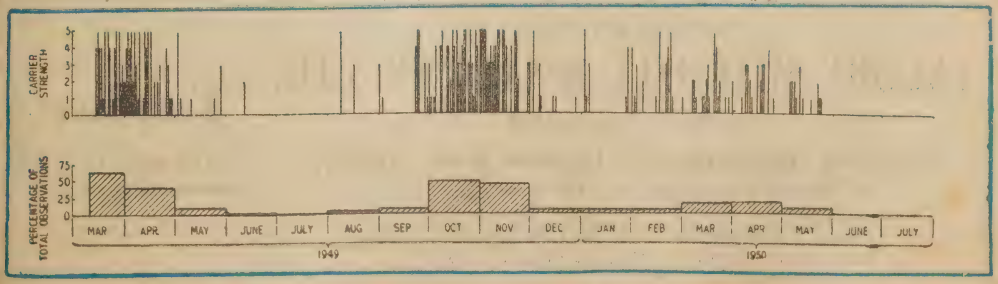

Figure 1. A graphical record of reception and signal strength and below, the percentage of reception reports.

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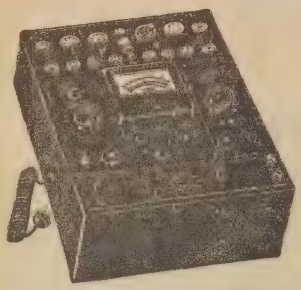

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0-3	0-6 mA	0-15	50-2250-100,000 ohms.
0-15	0-30 mA	0-150	x 500-22,500-1 megohm.
0-150	0-150 mA	0-300	x 5000-225,000-10 Megohms.
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0-600			x with external battery.

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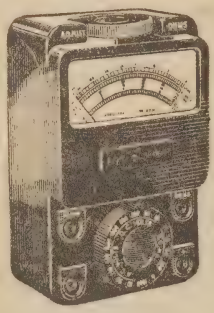
0—2.5	0—2.5	0—5 mA	—22 to +3	1000—50,000—10 Megohms
0—10	0—10	0—50 mA	—10 to +15	*10,000—500,000—100 Megohms
0—50	0—50	0—500 mA	+4 to +29	
0—250	0—250	0—5 Amps	+18 to +43	*With external battery.
0—1000	0—1000		+30 to +55	

This is a robust 20,000 ohms per volt 30 range universal multimeter designed for accuracy and stability. Fitted into an attractive case, the meter is provided with instantaneous OVERLOAD PROTECTION. The clear, easy to read scale has a length of 4 inches. An internal buzzer is provided for quick continuity tests. Complete with test leads.

PRICE £19/17/6 Plus Sales Tax.

MODEL 120A POCKET MULTIMETER



RANGES 1000 ohms per volt A.C.—D.C.

D.C. Volts	D.C. mA	A.C. Volts	Resistance
0—0.25	0—1	0—10	0.5—20—2000 ohms
0—10	0—10	0—30	50—2000—200,000 ohms
0—50	0—50	0—250	*500—20,000—2 Megohms
0—250	0—500	0—500	*5000—200,000—20 Megohms
0—500		0—1000	
0—1000		0—2500	*With external battery.
0—2500			

This is an accurate pocket size instrument using a robust, sensitive meter movement, fitted with instantaneous OVERLOAD PROTECTION and is housed in a high grade moulded case. All resistors used for voltage and current ranges are adjusted to an accuracy of 1%. Supplied complete with test leads.

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DIMENSIONS: 4⅞" x 3¼" x 2"

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Taylor Best for TEST EQUIPMENT

Manufactured by:— TAYLOR ELECTRICAL INSTRUMENTS LTD., GREAT BRITAIN.

PHOTOCELL UMPIRE MAKES NO MISTAKES

An interesting new electronic device can virtually take the place of a baseball umpire and, furthermore, can give precise information about the direction and speed of the ball.

THE electronic umpire was developed both as an aid to training and with a view to replacing traditional umpires, who, according to the text, are apparently "vulnerable to flying pop bottles."

Gadgets have been devised before to meet the same need but they have all suffered from the same limitations of being too bulky, too hard to transport or, alternatively, of such a nature that they have interfered with the swing of the bat.

The new device overcomes all these difficulties. One unit, containing the electrical circuits, is placed on the ground out of harm's way, and up to 25 feet from the battery. The other unit similates the home plate and may be set flush with the surface of the ground. No other ancillary equipment is required.

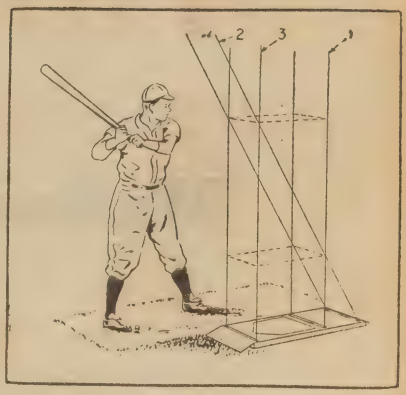


Figure 1. The ball must pass through the three intersecting planes in 1, 2, 3 order to record a strike.

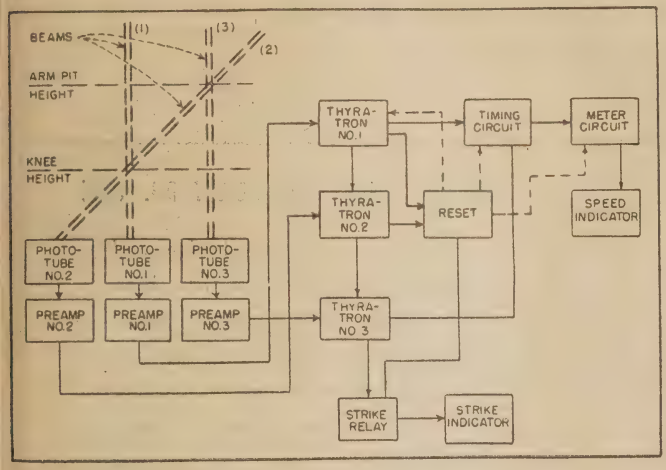


Figure 2. (Below.) Speed of pitch is recorded by measuring the interval required for the ball to pass between plane 1 and plane 3.

The scale of incline. the points of intersection can be made to correspond with knee and shoulder height of the batter.

Figure 1 illustrates the general operating principle. The base plate contains three phototubes each provided with its own optical system. This is so arranged that the phototubes "look" at a narrow slit of sky, two vertically upwards and the third along an inclined plane. By adjusting the angle of incline, the points of intersection can be made to correspond with knee and shoulder height of the batter.

When an object passes through any of the light planes, it varies the impedance of the appropriate phototube and causes it to fire a thyratron tube.

The three thyratrons are connected in series so that thyratron 1 must fire before power can be supplied to thyratron 2. Similarly, thyratron 2 must fire before number 3 can do so. Thus, the swing of the bat intercepting number 3 before number 1 cannot affect the operation of the device.

The ball, on the other hand, entering the batting zone, will fire the thyratrons in proper sequence and cause the strike indicator relay to operate. A high or a low pitch, on the other hand, will operate the phototube circuits in the wrong sequence and fail to operate the thyratrons. Similarly, a wide pitch, gives no indication because it will miss the light beams altogether.

The signal from the two vertical planes is taken off to a flip-flop circuit, which measures the time interval between the pulses and influences a charging and metering circuit to give a suitable reading.

In the event of a strike being recorded, the reset operation is automatically slowed up sufficiently to allow time for reading the ball speed indicator. An immediate reset button is provided to avoid unnecessary delays, particularly where the ball has failed to actuate all three thyratrons.

The optical systems are so constructed that the phototube is protected against direct rays from the sun. Below, the 19" slot is a system of lenses and mirrors which focuses the light from the sky through a narrow opening on to the phototube. A rotating mirror, suitably calibrated, controls the inclined light plane.

Figure 3 shows a method of calibrating the speed measuring circuits using a spinning disc. (From Electronics).

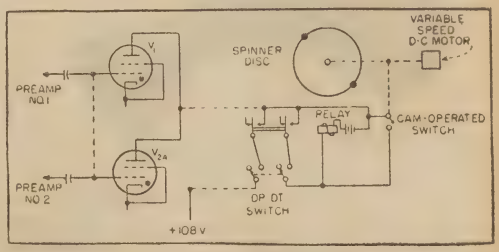


Figure 3. The electronic umpire is calibrated by a spinner disc that simulates balls travelling at different speeds.

DAYLIGHT ANYWHERE, ANYTIME

Producing diffused, cool and glare-free illumination, fluorescent discharge tubes are being more and more widely used for industrial, display and even domestic lighting. The light given off by some installations is so near to daylight that the difference can be detected only by delicate instruments.

FLUORESCENT tube radiation, as this form of lighting is named, has another advantage—it is much more economical to operate than ordinary electric lighting. One lamp of a given wattage will give at least two and a half times as much light as an ordinary electric light globe of equal power.

Installation is more expensive, however, because of the need to install a transformer or choke to control the voltage.

TYPICAL LAMPS

Sketched here in diagram form is a mercury-vapor or fluorescent lamp. It is a glass tube about 2in in diameter and having a brass fixing-cap at each end. Electrons pass from one of the tube's electrodes to the other through the rarefied gas in the tube, and the whole of the tube begins to glow.

Although electricity is not easily conducted through air at ordinary atmospheric pressure, it will pass much more easily through a rarefied gas. When the current passes through such a gas, a continuous glow is set up.

In the case of the fluorescent lighting tube, mercury vapor is introduced in rarefied form, while the tube itself is coated with a thin layer of chalk-like substance known as "fluorescent medium."

The tubes are little more involved in structure than the normal type of electric light bulb, and the operations of manufacture are few.

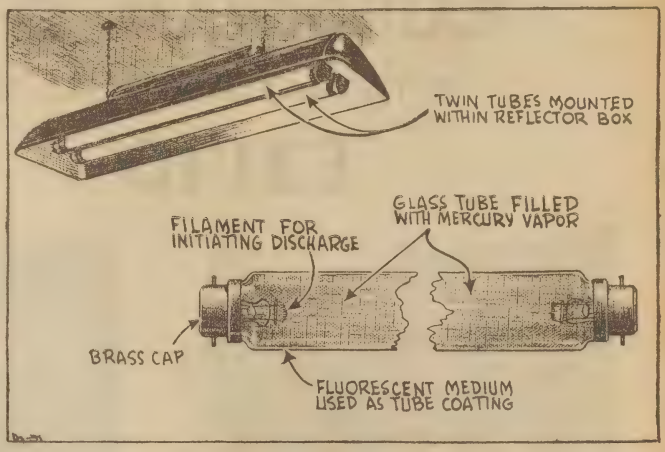
A length of glass tube is coated internally with the white fluorescent film. A tiny filament is fitted in the tube at each end. These filaments serve merely to start up the discharge process. Air is exhausted from the tube, which is then filled with mercury vapor at low pressure and sealed. A brass cap with contacts and pins is then fitted at each end.

NEARLY ALL LIGHT

A lighted "fluorescent emission" lamp gives out practically no heat at all, and the light is spread over so large an area of the glass surface that it produces far less glare than an ordinary electric light globe of similar power, where the light source is concentrated in a much smaller space.

Shadows are reduced, too, since the tube spreads the light evenly over large areas, instead of radiating it, as the ordinary globe does, from a sharp-point focus.

Interesting applications of fluorescent light in fields beyond its use for industrial, commercial and domestic lighting have been found.



Because every different kind of microbe gives off a particular color under fluorescent illumination, a new weapon has been placed in the hands of research workers. Fungus diseases and other plant infections can be detected by their fluorescence when exposed to light from selected discharge tubes.

NOBODY KNOWS YOUR NOSE!

(Continued from Page 13).

the same substance in high concentration.

Enough has been said about this theory to enable us to now consider the "chemical" theory.

This is also called the corpuscular theory and states that odourous substances give off chemical units or particles which are in gaseous form.

Such particles are capable of being conveyed to the olfactory mechanism by convection and diffusion and upon arrival at the mucous membrane induce chemical changes in the receptor cells.

Present day supporters of this theory point out that odours can be detected only in the direction of currents of air and therefore that the physical theory of Heyninx cannot be right because radiations would be detectable in all directions and even in a vacuum.

One of the most serious obstacles to the proving of this theory lay in the adequate demonstration of whether the odourous substance acted in the gaseous state or whether it was necessary for it to dissolve in the fluid of the olfactory mucous membrane.

It has been found that a solution of an odourous substance when introduced directly into the nasal passages induces weak odour signals but it cannot be proved whether the solution stimulated the odour senses or whether the gaseous odour-producing substance left the solution and affected the mucous membrane.

Nevertheless, this theory has many followers, despite its age.

It is remarkable that the olfactory mechanism is capable of selection in as much as, by training, an individual may focus attention on one particular odour among a number of others.

In the upper part of the nose there is a series of projections from the wall of the nose below the olfactory membrane. These are called turbinate projections.

In smelling an odourous substance such as a flower or a perfume it is necessary to sniff in short sharp intakes of air through the nose.

The reason for this is that the ordinary passage of air through the nostrils would not be sufficient to carry the odourous substance past the turbinate projections except by

(Continued on Page 96)

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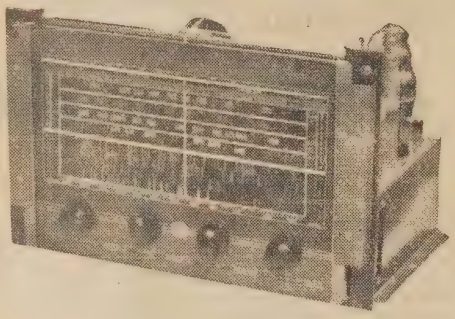

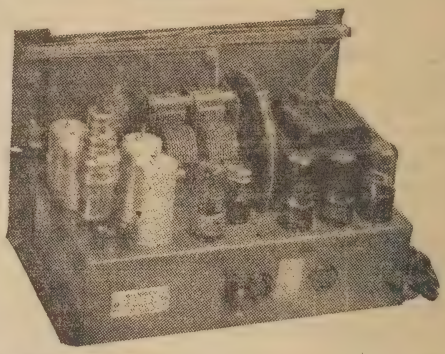

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Eight valve world range chassis with push-pull output. Uses new Philips ECH33 converter valve for better long distance reception. High gain audio with inverse feed back and tone control gives you the best reproduction from your favorite recordings. Radiogramo switch combined with short-wave switch. A.C. switch incorporated with tone control. Large calibrated edge lit dial with main stations in each State in prominent type, with counterweight drive. Provision for F.M. or television tuner. Permatuned iron cored coils and intermediates.

6 VALVE RADIOGRAM CHASSIS

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Collaro type 500 changers on A.C.504 players with crystal pick-up. Available for above chassis.

Large Variety of Combination and Console Cabinets Available from £12/10/-

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NEWS AND VIEWS OF THE MONTH

Bad Show!

WHAT a mess Aspro have made of the "Much Binding in the Marsh" show, which for years has entertained ABC listeners.

Murdoch and Horne in that time built up a beautifully balanced half-hour, which became virtually an institution. Its audience was enormous, well conditioned to laugh at the old jokes which came up time after time—greeting the team each night as old friends.

But Aspro have shot the show to ribbons with a series of high-pressure, common-place plugs, apparently oblivious of the fact that in doing so they have killed the goose they have bought.

If ever a show needed care in sponsorship, it was "Much Binding." Aspro have handled it with a meat-axe.

There is one consolation. The ABC is repeating an earlier series each week. And they sound just as good the second time.

FM and AM

A NEWS par of the month reminded us that the BBC is continuing with its series of tests on VHF broadcasting, the aim of which is to examine the use of these high frequencies for broadcast programmes.

The PMG is doing something the same here in Australia, the only difference being that the stations concerned, in Sydney and Melbourne, use only FM. The BBC is using both AM and FM in an endeavor to collect comparative data on each system.

Results of the tests are bound to attract world-wide interest if and when the results are published. We have always felt that there was insufficient evidence on this matter to justify the adoption of FM as being necessarily superior to AM for VHF broadcasting. Knowing the thoroughness with which the BBC works, its tests should prove a reliable pointer one way or the other for our own plans in the future.

Mighty Telescope

A REFLECTING telescope with a 74-inch reflector, designed for ultimate installation at Mt. Stromlo Observatory, Canberra, will be featured at the Festival of Britain exhibition, which opens in May.

The telescope, one of the six largest in the world, will be housed as an exhibit in the Dome of Discovery.

No such instrument has ever been on show at any similar exhibition. The only other telescope of a comparable size in the Southern Hemisphere is the one now in use at the Radcliffe Observatory, Pretoria, South Africa.

Both instruments were built by British craftsmen, though experience has led to some modification in the design of the new telescope.

Ordered by the Australian Government and specially lent for the Festival, the moving parts alone of the telescope weigh nearly 40 tons.

Yet it is so finely balanced that the slightest touch will move it.

Its mechanically controlled movements enable a selected patch of the heavens to be kept in view during observations.

Alternative systems provide for two different means of examining the star light-waves, depending on the purpose of the observation.

Whilst the design renders possible clear, undistorted pictures, covering fairly extensive areas of the heavens, the large aperture collects enough light from even very weak stars to photograph them.

The installation of this telescope at Mount Stromlo after the Festival will add greatly to the facilities for study of stars which can only be seen in the Southern Hemisphere.

Among other important astronomical problems which it may help to solve are those connected with the structure of the Milky Way.

TV Balance Sheet

ACCORDING to figures released by the FCC in America, TV stations, 98 in all, lost 25 million dollars in 1949, while radio broadcasting stations made 56 million dollars.

In effect, this means that about 100 TV stations lost a sum equal to about half the total profit of more than 2000 broadcast stations. This television is certainly a costly business. It is almost certain that this record of losses will be continued for some time to come.

Incidentally, the figures show that 684 radio stations lost money in 1949, as against 160 stations for the preceding year.

POPULAR SCIENCE QUIZ

Q.: What type of instrument is a hygrometer?

A.: A hygrometer is a device which measures the relative humidity of the air or atmosphere. The sensitivity of the human hair to humidity forms the basis of operation of one type of hygrometer. This type is known as a "hair" hygrometer in which a hair several inches long operates a needle on a dial as the hair expands with moisture and contracts with dryness.

In the "wet and dry bulb" method two thermometers are used, one of which has its bulb enclosed within a wet wick. The cooling effect of the evaporation of water from around the bulb lowers the reading on this thermometer. When the air is saturated with moisture, there is no evaporation from the wet bulb and both thermometers will show the same reading.

Conversely, when the air is dry, a considerable amount of evaporation will take place and the readings of the thermometers will differ. The relative humidity in per cent can be obtained by noting the difference in the thermometer readings and looking up a set of tables based on these differences.

Q.: We often hear mention of the International Date Line. What is it and where is it located?

A.: It is quite obvious that it cannot be the same time of day at all points on the earth's surface. Actually, if you travelled westward from the Greenwich meridian, you would gain one hour for every 15 degrees of longitude covered. This adds up to 24 hours, or one complete day, for the full 360 degrees around the earth's surface. Conversely, if you travelled eastward, you would lose one complete day for the whole trip.

Consequently, to keep the world calendar in step, the International Date Line has been established at the 180th meridian in the Pacific Ocean to mark the change of day. This meridian is displaced by an equal time interval east and west of the Greenwich or prime meridian.

In crossing this line when travelling east, there is a gain of one day to make up for the time lost in heading eastward. When travelling west across this line, one calendar day is dropped to balance the time gained in heading westward.

Q.: We all know what caves are but what causes them?

A.: Underground erosion causes caves. In limestone regions caverns are formed by the action of running water containing dissolved carbon dioxide. Such a solution forms carbonic acid which has the property of dissolving limestone and other mineral matter.

The action begins where limestone is cracked. As the acid solution "eats" into it slowly, it continues to form an ever-widening space which finally becomes a cave.

The result of exacting research and design, R.E.L. were rewarded with the ultimate

ELECTRONIC MULTIMETER AND PROBE

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VACUUM TUBE VOLTMETER

£26½ PLUS TAX

Terms available from £10 deposit.

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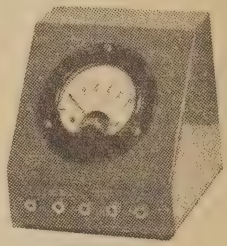


EXTERNAL MILLIAMMETER

With the Introduction of F.M. and Television the Electronic Multimeter was designed to perform functions beyond the capabilities of other measuring instruments, it does possess numerous advantages. One of the most important of these to a person requiring to make voltage measurements under varying conditions, is that this Electronic Instrument draws a negligible amount of current from the circuit under test, that is the circuit under test is not disturbed or loaded to any appreciable extent. This is of the utmost importance in valve element voltages in radio circuits as frequently the amount of available power in the circuit being tested is measured in microwatts. It is clear then that a conventional meter which draws thousands of times the total available power cannot be used to make measurements in such circuits, and the Electronic Multimeter becomes necessary.

Quickly it finds the most elusive intermittent, noisy, open or short circuits.

Easily operated without fumbling, it is an absolute necessity to all busy Radio Men. Works from 230 to 260 volt A.C. supply independent of line fluctuations.

Accurately calibrated in separate colours on a 4" square dial (mounted in sloping panel) are direct readings on all tests including: All Voltages, Resistors, Condensers, Coils, Transformers, Valves, Speakers, High Resistance Leaks and Faulty Insulation, up to 1000 megohms.

Versatility plus sensitivity, enable testing and checking of all circuits: A.F., R.F., U.H.F., and A.V.C., under operating conditions--without disturbance.

Guarantee We supply written guarantee with each Electronic Multimeter which covers the instrument for 6 months.

Dual Diodes The Instrument has been fitted with an internal diode and external Probe for A.C. operation. The internal diode permits the measure of A.C. with or without the Probe removed. The Probe is Insulated throughout with Polystyrene which enables it to be used on all frequencies up to the U.H.F. spectrum.

External Milliammeter As popularly requested, the Milliammeter shown in the diagram has been designed to cover the need where current and voltage are to be measured at the same time, as is usually the case when measuring plate current, etc. This four-range Instrument is attractively housed in slope panel metal case to match with the Electronic Multimeter.

RANGES

The R.E.L. Instrument will read A.C., D.C., and —D.C. volts with input impedance over 10 megohms, for all D.C. ranges and only slightly less for A.C. ranges.

High Resistance D.C. Voltmeter

0 to 3v 0 to 10v 0 to 30v
0 to 100v 0 to 600v and 0 to 1800v.

A.F., R.F. and U.H.F., A.C. Range with internal diode or external probe. 0 to 3v, 0 to 10v, 0 to 30v, 0 to 100v, 0 to 600v.

Resistance five ranges from 0.2 ohms to 1000 megohms.

External Milliammeter

0-1ma., 0-10ma., 0-50ma., 0-500ma.

NEAR LIVERPOOL ROAD. OPEN SATURDAY MORNING.

Jet News

FIRST item of jet news this month is the decision to manufacture in Australia the American Sabre jet fighter in place of the British type originally planned.

The Sabre has been tested in combat in Korea, and is reported to be the only fighter capable of outperforming the Russian jet fighters which have appeared in that area.

The decision to make the American design was probably influenced by a desire to preserve uniformity in major equipment with the USA. In the case of hostilities in the Pacific it is likely that close cooperation with American forces will be required. A lesson from the last war underlined the difficulties of operating with aircraft and equipment from Britain, America, and Australia, much of which was not interchangeable, and which called for separate maintenance procedure.

Britain's star fighter at the moment would seem to be the De Havilland Venom, successor to the famous Vampire, Australian-made versions of which have featured in spectacular flights over Australian cities.

The Vampire is long outmoded as a front-line fighter, but is being mass produced in Italy by Fiat, Alfa-Romeo and Macchi for use by the Italian Air Force. It is still useful for training, however, so essential for successful employment of the faster aircraft.

Second item is that the Comet jet air-liner is likely to be seen in Australia during 1951.

This aircraft, another triumph for De Vavilland, provides sensational speed and general performances for an airliner, and may be regarded as a land-mark in the development of the airliner of the future.

Pictures of the Comet in flight were recently shown in Australian newsreel theatres; seemed to vindicate its reputed behavior in the air.

Speaking of newsreels, did you see the shots of the American B26 bombers departing from Britain on their return to the USA?

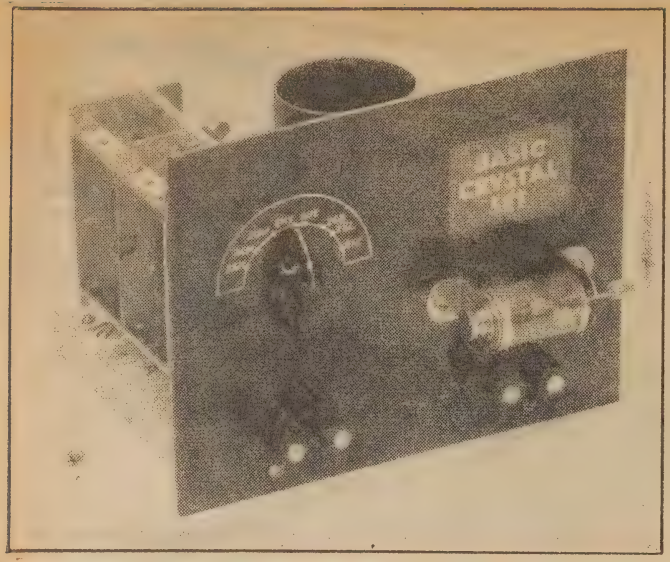
These giants, the largest aircraft in the world, made a magnificent picture as they left the runways in their jet assisted take-off. These jets, together with the six airscrews, give each aircraft more power than the average ocean liner.

RCA Surrenders Trade Names

SEVERAL registered trade names belonging to the RCA have been surrendered for public use.

The names are "Iconoscope," or television camera tube; "Kinescope," the picture tube in a television receiver; "Acorn," used to describe possibly the first miniature valve specially designed for VHF operation; and "Orthicon," an improved television pick-up tube.

RCA have taken this step because of the wide use of these names by the radio trade—so wide that in any case enforcement of registration rights would be impracticable.



This front view of the crystal set gives a good idea of the layout. The crystal detector is the adjustable type which was used for our first tests. Beneath it are the headphone terminals, while the aerial and earth terminals are on the left.

Learn While You

You don't know a mortal thing about radio, but you want to build a set? You're completely mystified by technical terms and symbols? Right. You're the person we're after. Read through this article, then do as we say for the next six months and you'll finish up with a mantel set and a good working knowledge of this most fascinating hobby. Give it a go? Good! It's a bargain.

IN actual fact, we want to put you through a kind of radio course but one with an important difference.

Most radio courses go on and on and leave you with a pretty fair idea of how a radio works. The only trouble is that you don't always learn what it looks like.

We are aiming to reverse the approach — to tell you how to build things and, at the same time, to explain how they work. After that you should be well equipped to advance your knowledge from the other articles in the technical section.

And how much will all this cost? Frankly not much and not a penny more than we can help. We aim to arrange the articles so that you buy just a few things each month. What's more, at the end of the period, you should be the proud owner of a neat little mantel set. Need we say more?

The first and obvious step is to build a crystal set. It won't cost you a great deal, you can't blow anything up and provided you live within 10 or 15 miles of a broadcast station, you can hardly fail to hear signals. In fact, you should hear quite a few.

But whether you build this set merely as a stepping-stone to a larger one, or whether you intend to keep it as a permanent unit, making it will give you some valuable experience—and a lot of fun!

One of the biggest hurdles which face the beginner is the circuit diagram. This method of portraying a set has not been devised "just to make it harder." On the contrary, once a few simple facts have been grasped, the circuit diagram makes it immeasurably easier to follow the description of a set.

The more complicated the piece of apparatus, the more valuable this system becomes. In fact some of the most modern equipment would be almost impossible to portray by any other means.

If you start by "beating" the circuit diagram of a simple set, progress from there on will be comparatively easy, and almost automatic.

The first thing to do is to familiarise yourself with the symbols. This is not very difficult because they have quite a marked resemblence to the units they portray. To help you get the general idea, we are showing the main symbols used in the crystal set, together with photographs of the components in real life.

THE SYMBOLS

The first of these is the coil, and the similarity between the symbol and the actual component is at once apparent. When you come to think of it, it's hard to imagine an easier way to portray it.

Alongside this is the tuning condenser which, reduced to the simplest terms, consists of two conducting plates separated by a non conductor, or insulator. Our symbol therefore portrays the two plates as two lines lying side by side, and the space between them represents the insulator.

Since one of the plates is movable, one line is shown curved, and usually has an arrow head at one end. In the case of the fixed value condenser, the two plates are shown as two straight lines side by side.

In a like manner we have symbols for crystal detectors, headphones, aerial and earth &c., and we think you will agree that they are all a very logical approach to the problem of portraying components in a simple way.

CIRCUIT DIAGRAM

Now let us look at the complete circuit. Here symbols are connected together by means of lines which are intended to represent wires. Where it is necessary to cross these wires, but it is not intended that they be connected, a small semi-circular loop is used to indicate a non-connecting cross-over. Actual connections are usually emphasised by means of a small dot at the junction point.

Thus the primary purpose of the circuit is to show how the various components are to be connected together.

For example, in our circuit you will see the aerial symbol shown in the top left of the diagram. Starting at this point, we follow the wire to the next point of connection. This is the little arrow head near one of the coil tappings and it indicates that the aerial is to be connected to a

tapping. The arrow head indicates that the connection is not a permanent one, but that adjustment is possible by making connection to other taps.

In practice the aerial lead would not run direct to the coil tapping, but would make its connection through a terminal mounted on the panel or baseboard. This is simply a matter of convenience and, since it does not alter the electrical conditions of the circuit, we do not bother to show it.

TUNING CONDENSER

By studying the circuit further you will see that the tuning condenser is connected between the two ends of the coil, that the crystal detector connects to another tapping on the coil, and the other end of it goes to one side of the headphones. It should be a simple matter for you to work out the remaining few connections for yourself, and will provide good practice.

The next big problem which faces the beginner, is when he picks up a component, decides where it is to go in the circuit, and then asks, in effect, "which way round does it go"

In many cases it does not matter, but when it does this information is usually carried in the circuit diagram. In this set, for example, the only component we need worry about is the tuning condenser, which is best connected with the moving plates to the earth side of the circuit. This is clearly shown because, as we have already pointed out, the moving plates are represented by the curved plate.

CONNECTIONS

If you examine the condenser carefully you will find that the moving plates are mounted on the frame, while the fixed plates are insulated from it with bakelite strips. Connection to the moving plates may therefore be made to any part of the frame, and to the fixed plates by any one of the solder lugs provided.

As you progress to bigger circuits you will find more components marked in some way to indicate that a definite "polarity" is to be observed. For a start we will draw your attention to them, but you will soon learn to look out for them for yourself.

Now it is wrong to imagine that a circuit diagram can tell you everything about a set. This is probably another reason why some fellows are scared of a circuit diagram: they imagine that it contains more information than it does, and when they fail to find the information they seek, become disheartened.

True, an experienced person can often (but not always) work with nothing but the circuit, but until that stage is reached we will have to discuss such things as component types and ratings, physical layout, and some constructional details.

Make It!

by Philip Watson

Well now, let us get down to some of the additional details necessary for our crystal set. The original set was built on a wooden baseboard, with a bakelite front panel. The bakelite is not essential, and it would be quite in order to use masonite or plywood, provided they are quite dry.

The tuning condenser is of the two gang variety, which is larger than required for this set, but we are keeping in mind the more advanced circuits which we will be describing in following articles. By spending a few extra shillings at this stage you will avoid having to discard a single gang and purchase a two gang later on. For the moment the unwanted section is simply ignored.

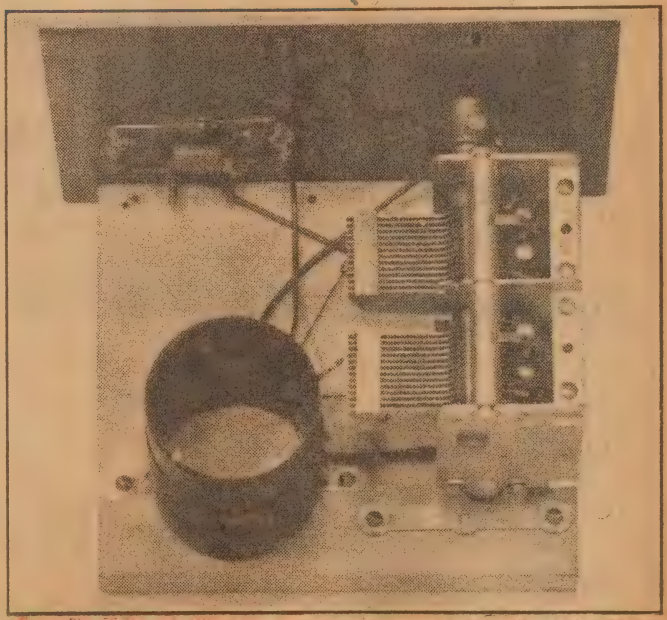
The coil is home wound, and ours consisted of 65 turns of 24 gauge enamelled wire, on a two inch former, tapped every 10 turns. First drill two holes about a quarter of an inch apart, and three quarters of an inch from the edge of the former. Pass about six inches of wire through one hole, back through the other, then through the first again. This will provide a secure anchor point for the start of your winding.

THE COIL

Wind on 10 turns, and then twist in a small loop to act as their first tapping, wind on another 10 turns, make another loop, and so on until the required number is completed. Two more holes in the former serve as the anchor point for the finish of the winding, and these have to be drilled while the winding is held tight.

If you use the same size wire and former as in the original, we can tell you that the winding was just one and a half inches long and you can drill suitable holes before you start. Otherwise it may be advisable to have someone handy who can drill these holes, and perhaps give a hand with the tapping loops. After the winding is completed, clean the loops gently with emery paper and tin them ready for the connections.

A different size of former will call for some adjustment in the number of turns. For a three inch former about 80 turns will be required. If



fixed detector, and this may be seen on the left of front panel.

METERS ——

METERS ——

METERS ——

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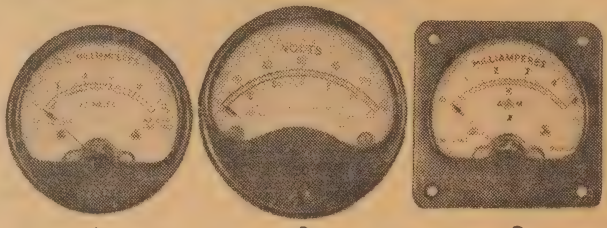

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37/6

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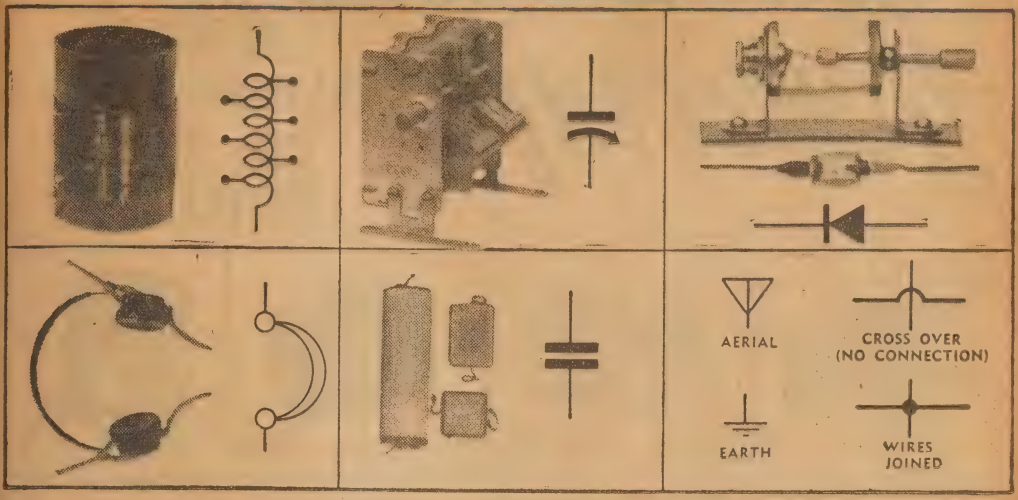
A HANDY GUIDE TO THE CIRCUIT SYMBOLS



The components used in the crystal set are shown here, together with their circuit symbols. The two types of crystal detector, although different in physical form, are given the same symbol. The same applies to the fixed condensers of which there are many varieties, all represented in the same way. Below is the circuit diagram in which these symbols have been used to portray the complete set. See if you can work it out.

you are not quite sure of the number required, err on the side of too many, as it is very much easier to take turns off than put them on. The size of wire is not particularly critical, but if it is much larger than that specified, you may need a longer section of former.

CRYSTAL DETECTOR

The coil is mounted by means of two small brackets, made from scrap aluminium, and bolted to the former at one end. Attach to the baseboard by small woodscrews.

Two types of crystal detector may be used. One is the old fashioned adjustable "cats whisker" type, and the other is the latest type germanium diode. We tried both types with this set, and found that the germanium gives signals as strong, if not stronger, than the best spot you will find with a crystal.

However, such a spot takes quite a bit of finding, while the germanium unit is a fixed device, needing no adjustment, so you can be sure of getting the best results all the time. This advantage appears to far outweigh the slight extra cost of these units.

Of the various types we were able to try, the GEX33 gave the best results, and seems most suitable for this kind of work. On the other hand, if you want to keep the cost to a minimum, and you don't mind the bother of searching for spots, you can settle for one of the older adjustable variety. Choose one which is easy to adjust, and you will find that a light pressure is helpful in finding sensitive spots.

A good pair of headphones is essential to get the best results from a crystal set. Some of the low impedance types available through disposals give good results, although they are not ideal for the job. There are some disposal types of about 2000 ohms available, and these are a better proposition. If you do not care to outlay on this item it might be possible to borrow a pair, until you progress into the loudspeaker stage.

The only other component is the small condenser connected across the headphones. This may be of the mica or paper variety, and is not particularly critical.

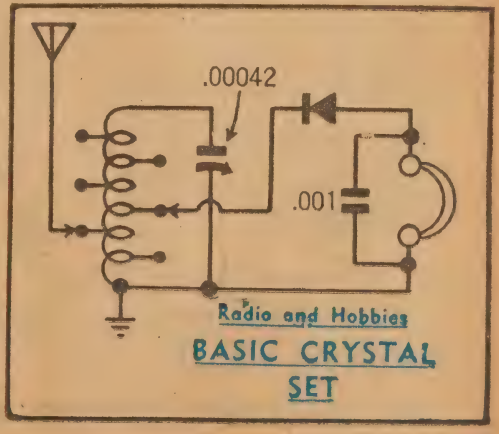
TUNING CONTROL

As will be seen from the photographs, the crystal detector, in either form, may be mounted on the front panel. Connections for the aerial, earth and headphones are made to terminals also mounted on the front panel. Solder lugs under these and provide a connection for the various leads.

The use of a modern type of gang in this set presented something of a

PARTS LIST

1 Base board 6" x 5½" x ¾".
1 Front panel 7" x 5½".
1 2 gang condenser (Stromberg Carlson or AWA).
1 3" length of 2" diameter coil former.
1 Adjustable crystal detector with crystal or
1 GEX33 germanium diode.
1 Pair high impedance headphones.
4 Terminals.
1 .001 mfd. condenser.
1 Pointer knob.
Small quantity of enamelled wire (see text), solder lugs, hook-up wire, nuts and bolts, etc.



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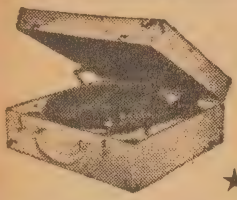

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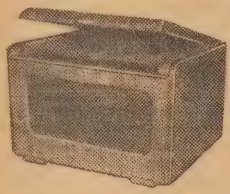

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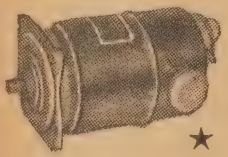

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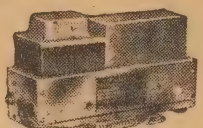
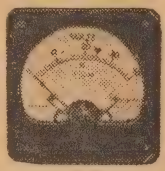


ENGLISH INVERTERS. Valvadio, 32-volt, D.C., input, 240 volts, 50 cycle output at 100 watts. Price, as illustrated, £22/13/6.



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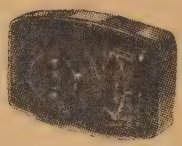

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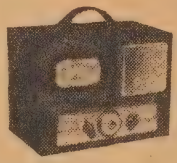

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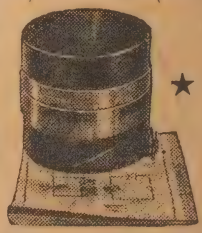
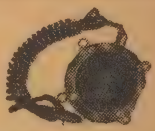


BURON CRYSTAL SET COILS. Complete with circuit diagram. 4/6 each.



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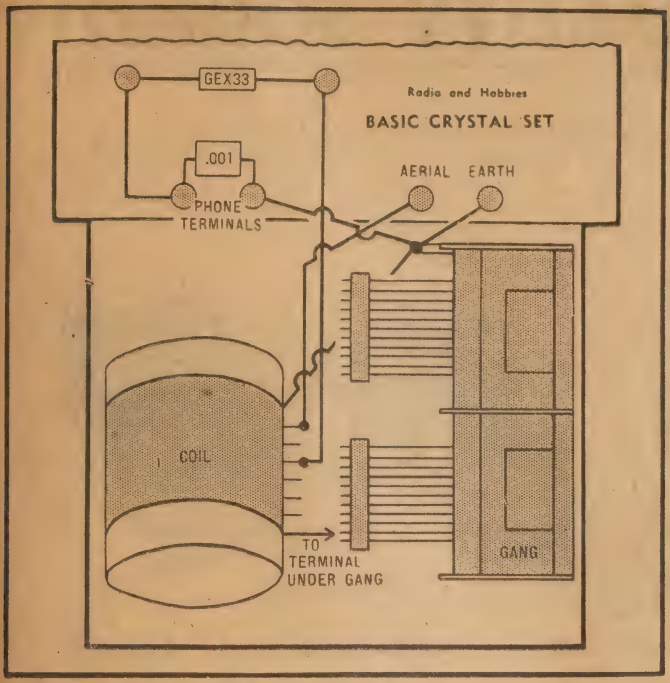
COMPLETE WIRING DIAGRAM



This wiring diagram shows clearly the layout of all the components and should be compared with the photographs. The coil has been shown at an angle in the interest of clarity, and for the same reason the front panel has been folded forward.

problem, namely, that of a suitable tuning knob. There does not appear to be any simple knob on the market which will fit a 3/8 inch shaft, while a set of this nature hardly warrants an elaborate dial.

Finally we decided to use a 3/8" to ¼" extension spindle, thus making possible the use of a standard ¼" pointer knob. The gang will have to be mounted back from the panel slightly to allow for the extra length, and the excess of ¼" shaft cut off to bring the knob close to the panel.

THE AERIAL

After the set has been tested and the stations identified, they may be marked on the front panel. It is best to decide on the aerial which is to be used with the set, since this will affect the position of some stations.

Ideally, the aerial should be slung outside the house, as high as possible and about 40 feet long. If you are well away from all the stations, something higher and longer will be desirable. You must have an earth wire, running either to a water pipe or to a length of piping driven deep into moist soil.

To test the set, connect the aerial terminal to the first tapping on the coil from the earthed end, and the crystal tapping to the second or third tap. With headphones, aerial and earth connected, rotate the gang in search of signals. If you are using a fixed detector and there is a station anywhere within about 15 miles, you should have no difficulty in receiving it.

With one of the old type detectors you will have to try various spots on the crystal, and rotate the gang through its full range each time. When some kind of a signal is received, leave the gang set and search for a better spot on the crystal. When you think you have the best one, rotate the gang again in search of other stations.

Next, try the effect of various tappings on the coil. In most cases the original aerial tapping should be the best, although a lot depends on the size of the aerial. Moving to tappings further removed from the earth end, produces what is known as a tighter coupling, and the effect of too tight a coupling is poor selectivity and coverage.

In the first case the stations will overlap badly, and in the second you will find that those at the high frequency end will have been pushed right off the dial. In general, a tighter coupling is permissible with a small aerial than with a large one.

The effect of a tight coupling to the crystal detector, is to increase the signal strength, but only at the expense of selectivity. Thus a lot will depend on your location, and there is room for quite a lot of experiment in this regard.

We spoke earlier about learning

(Continued on Page 93)

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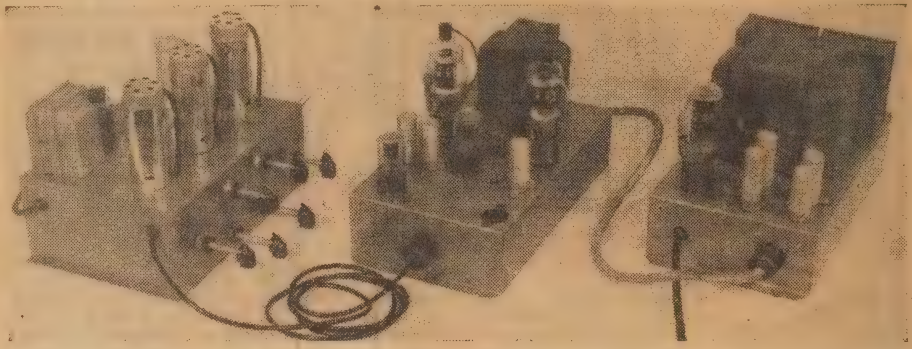

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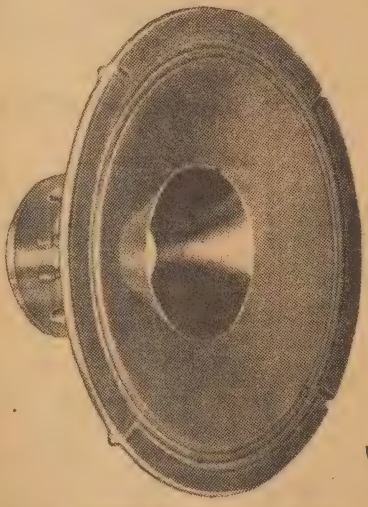

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FROM THE SERVICEMAN WHO TELLS

Intermittents seem to be on the increase. At least I am getting more than my share of the wretched things. Perhaps that is why this article contains some rather caustic remarks about this type of fault. There ought to be a law against it, anyway!

IT'S funny how some jobs creep up on you when you least expect them. In this case I was well outside my usual territory and on a mission quite apart from radio. I had, in fact, endeavored to put all thoughts of work out of my mind, at least as far as is possible for a radio man.

I was relaxing in a friend's lounge, to be precise, enjoying a "cuppa," when it happened. The radio had been playing softly, just a nice background level which I had hardly noticed. Suddenly it leapt to full output, and my host rushed to turn off the terrific din. He made a few explosive remarks and then explained that it "often did that."

THOSE INTERMITTENTS!

Now I suppose I detest intermittent faults as much as anyone, and I had a horrible feeling that this was not the last I should see of this one.

I was tempted to change the subject quickly, but somehow felt that the honor of the profession was at stake. So I asked my friend if he had tried to have the set fixed. "Been back to the agents three times," he replied, and I could see his blood pressure rising, "but they say they can find nothing wrong with it."

I said I thought they should be able to do better than that, at which the owner's face brightened. "You're a radio man, aren't you? Would you like to have a go at it?" At that moment I could think of nothing I would like less. I made a last effort. "These jobs often take time, sometimes several weeks. It means you'll be without a set."

NO WAY OUT OF IT

"I think I can borrow one," said the owner, "but in any case, this one's got to the stage where I was ready to put the axe through it"—and by the look in his eye, I think he meant it!

We found a screwdriver to fit the knobs and duly deposited the set in the back of the truck. Before leaving, I cross-examined the owner for any clues which might help. It was the same old story: Volume could be restored by switching the set off and on again, or sometimes by operating a light or power switch in another part of the house. It wasn't much help, but I thanked him and departed.

On the way home I began meditating on intermittent faults in general, as well as this one in particular. Why do most servicemen, yours truly included, live more or less in perpetual dread of the things? Really, I suppose, there are two reasons, one is the purely technical aspect, and the other the economic one.

This last problem can be really serious, for if one spends too much time tracking down the fault, the account looks like a bill for a new set. The owner is likely to remind you that Ned Kelly died many years ago!

TIME WASTING JOB

If you have never been faced with one of these faults, you may wonder why the job can take so long. If the fault, when it eventually does show up, only had the decency to remain stable for a few minutes, one could probably get to grips with it. But does it? Not a bit of it. Try to read voltages, or to by-pass a suspected component with a new one and, presto, your fault has vanished! Not only that, it may be several days before it condescends to show up again.

You would imagine, of course, that being so touchy in an electrical sense, they would also respond to mechanical vibration. But no. You can often pound the chassis, tug on the components, and tap the valves. The set will continue to play, quite determined not to misbehave until it is good and ready.

Of course there are exceptions to most of these symptoms, which is why I usually try all the things which I have just said do no good. Occasionally, but only occasionally, one strikes the jackpot. Usually you need to be well equipped, both with test gear and experience, in order to make a reasonable charge and still keep the wolf from the door.

Back at the shop I cleared a corner of the bench where the set would be out of the way, and prepared for a long period of observation. As I have said, it is no use waiting for the set to fade before you start testing. The idea is to get in first, connect meters to various sections, note the readings while the set is normal, and wait.

AVC VOLTAGE

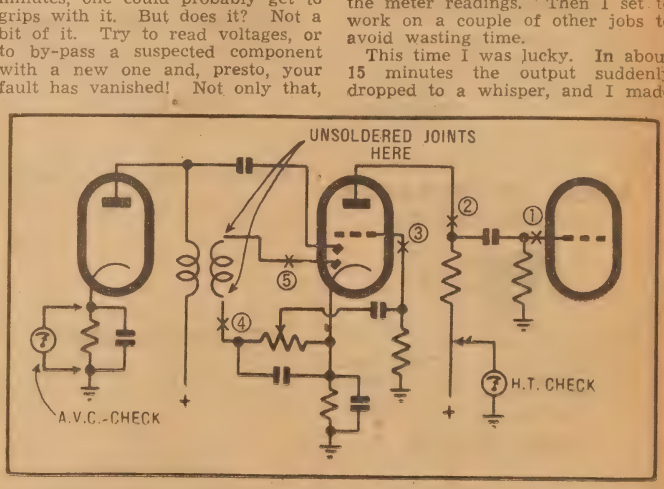
The AVC voltage is a very valuable indicator in these cases, so I connected a voltmeter across the bias resistor of the IF tube. A second meter was connected to the HT, and finally the audio section of the signal tracer to the grid of the power valve. (The signal tracer has quite recovered after its recent indisposition, thank you kindly.)

I tuned in a local station, found the gain setting required on the tracer for equal volume, and noted the meter readings. Then I set to work on a couple of other jobs to avoid wasting time.

This time I was lucky. In about 15 minutes the output suddenly dropped to a whisper, and I made a quick check on the meters. The AVC meter had not shifted, nor had that on the HT line. I advanced the gain of the tracer to what should have given a normal signal. There was only a whisper.

This meant that the fault lay somewhere between the grid of the power valve and the second IF primary, the point from which the AVC voltage was derived.

While the fault was still evident I moved the tracer prod on to the plate of the audio tube. As I made the connection there was a click from the set speaker, and the volume was back to normal. Yes, touchy things, intermittents.



Illustrating how an intermittent fault was traced in a receiver. Numbers indicate the sequence of test points.

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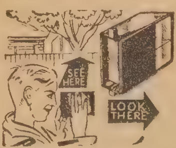

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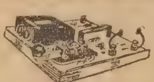

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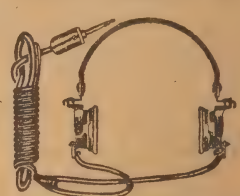

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Still, I felt I had made some progress, for there was now a much smaller section of the set under suspicion, and it did not include a very compact dual wave bracket.

I left the tracer connected to the audio plate, and re-arranged the metering. This time the bias of the audio valve was placed under observation, as I had an idea that the trouble would effect the valve operating conditions, showing as a change in the bias voltage.

NEW EVIDENCE

It was not until the next day that the fault was repeated, and it proved my theory wrong. The operating conditions of the valve were quite stable. It also indicated that the fault was in the direction of the IF transformer.

As successive failures occurred, the tracer was moved from point to point through the audio stage, but on no occasion was I able to make more than one test at a time.

Finally, having checked right through the diode load circuit, the detector diode pin was reached, and the signal subsequently faded at this point also.

As far as I could see this only left one component in doubt, the IF transformer. However, a preliminary test with the low ohm meter showed normal resistance, at least until I exerted some pressure on one of the secondary pins. This produced a barely perceptible flicker of the needle, so I removed the can and tugged gently at the lead. There was no doubt about it this time, the needle was kicking up and down the scale.

I peeled off the wax expecting to find a dry joint. It was dry all right, it had never had a soldering iron near it. Just bare wire wrapped around the pin! The other secondary pin proved to be the same, so the primary and the other IF were checked as a precaution, but proved to be quite OK.

SUCCESS AT LAST

A few minutes with the soldering iron was all that was necessary to set things right and, after the usual alignment check, the set was returned to the owner.

I was telling this story to a group of technical friends, and it naturally prompted discussion on the various methods they use to track down the intermittent gremlin.

One of them maintained that he received more than his fair share, but that the fault was always of the same nature, namely condensers. Perhaps the fact that he handles large numbers of the same make of set has something to do with it, for the particular brand of condensers have been known to give a lot of trouble.

Anyway, his approach is immediately to replace all condensers, without wasting time to track down the individual offender. I, naturally, queried the economics of this idea, but he maintained that it is cheaper than spending many hours looking for the particular condenser.

This is certainly a novel approach, and it seems to work in his particular case. I couldn't help feeling, though, that he had had a certain amount of luck, as I know from my own experience how often this trouble has an entirely different origin.

Another chap works in the service-department of one of our well-known set manufacturers. "We get our share," he said, "but we are pretty well equipped to tackle them." He went on to describe a rather fantastic device, developed in their own laboratories to deal with this problem. It seems that provision is made to simultaneously monitor almost every characteristic of the set, both static and dynamic. About a dozen meters are used, some being of the VTVM variety to check signal level in various parts of the set.

A test signal is fed into the set, and the output is connected to a relay. This holds open a set of alarm contacts, so that as soon as a "fade" occurs the relay drops out and an alarm is sounded.

A time switch turns the whole system off and on at regular intervals, as it has been found that this sometimes stimulates the gremlin. Another form of stimulus is heat, and in this case heating units are available to place under the chassis if required.

As I said, the whole thing smacks of the spectacular, but I have no doubt that, in a large organisation, it would pay good dividends.

The discussion brought to light another form of attack. This is to observe very carefully the nature of the remaining signals when the volume drops. The actual level, distortion, &c., are carefully noted, after which the set is allowed to return to normal. If a condenser is suspected, these are now disconnected one at a time until one is found which exactly reproduces the effect which was previously observed. This component then is most likely the offender.

As I left the group I made a mental note that some of the suggestions could profitably be made more use of on my own bench. At the same time it is very hard to lay down hard and fast rules for this kind of fault, and a bench full of test gear is no guarantee of success. Granted, some test gear designed for this work is a great help, but one needs experience as well. That is why I usually find that a general exchange of ideas with my confreres is helpful all round.

A HANDY TIP

Finally, I must pass on a little tip which came my way recently. I had occasion to replace a valve socket in a small mantel receiver, having what the maker was pleased to call, a compact layout.

Anyway, this particular socket was located half under a resistor condenser strip, which extended several inches in both directions.

Removing the socket was not particularly difficult, however, as I was able to keep the nut stationary, by exerting slight tension on the head of the bolt. With the bolts removed, I was then able to move the socket towards the edge of the chassis sufficiently to get a soldering iron to the lugs.

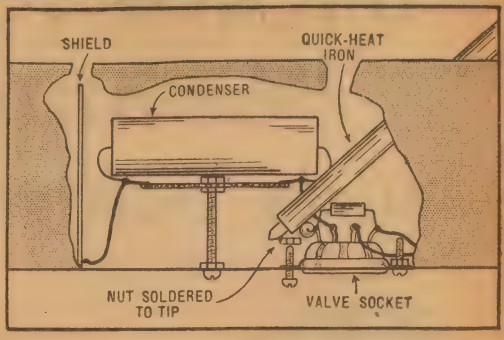
In a similar manner I was able to wire in the new socket, and even fit the nut and bolt nearest to the end of the chassis. But the one under the strip positively defied me.

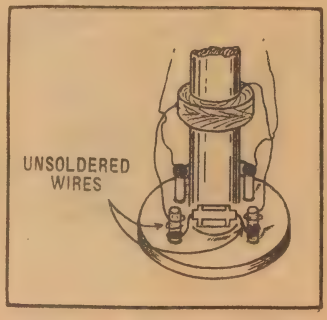
I tried every trick I knew. First my fingers, but the best I could do was to just reach the tip of the bolt with one finger, and then only with it twisted in a most uncomfortable manner.

Next the long-nose pliers, but they just overshot the vital position. I tried the bent-nose pliers, but they were bent in the wrong place. (Aren't they always!). Sliding the

A NOVEL JOB FOR AN IRON

A new trick for holding a nut in a difficult spot. Sweat the nut to a quick-heating soldering iron and hold it in place. Heat the iron again to release the nut.





The cause of an intermittent failure. Someone had forgotten to solder the litz strands.

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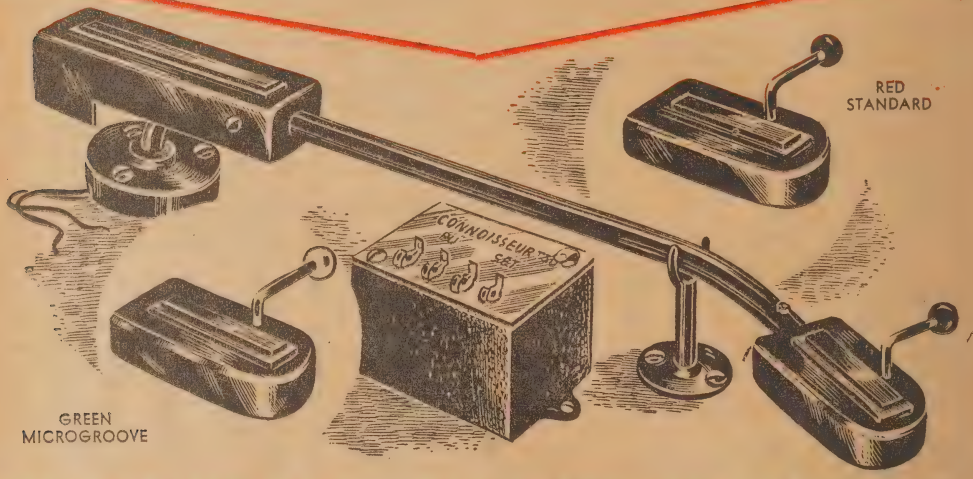

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nut down a piece of tinned copper wire on to the end of the bolt came nearest to success. But when I tried to keep it in place, stop it from turning, and turn the bolt, I found I needed the proverbial three hands.

It was just on closing time, and I was determined to get the job done before I knocked off. I didn't relish having such a stupid but irritating problem hanging over my head all night.

At this moment my amateur friend walked in. I must have looked rather hot and bothered, because his first remark was, "Hullo, in trouble?" I indicated the general area of conflict, and made some not very complimentary remarks about the person who designed the layout.

WORDS OF WISDOM

"Well, now," said my friend, "a simple problem like that should not bother a clever and experienced man like you." I replied that the sarcasm was not appreciated, and suggested he might like to have a try at it himself.

"Think it will bother me, eh?" he said, with a grin which should have warned me that he had a trick up his sleeve.

"Get that nut on within the next few minutes," I retorted, "and there will be time for me to shout you."

My friend quickly took stock of the position of the bolt, the angles involved, and picked up the quick-heat soldering iron. He heated the iron and soldered the nut to the tip of the bit, sticking out at what he judged to be a suitable angle. He waited for a few seconds for the iron to cool, then poked it down through the maze of components. The angle apparently was not quite correct, for he withdrew the iron, re-heated it, and set the angle again.

This time he picked up the thread in a few seconds, and screwed the assembly up tight. A quick application of power to the iron was all that was required to free it, and the job was done.

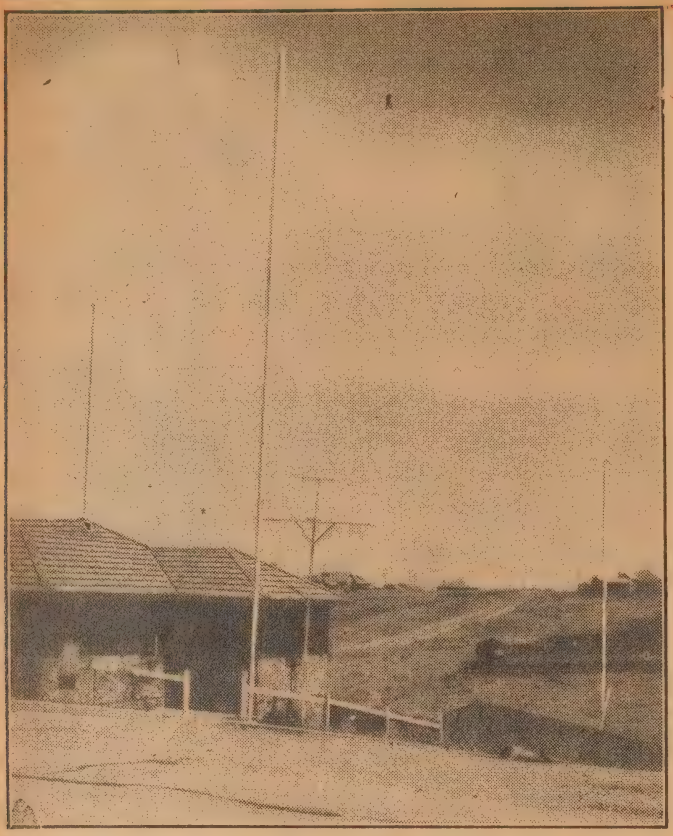
"And now," said my friend, "about that shout."

"OK," I replied, "you can go ahead and order while I lock up. Make mine a caramel malted!"

ARTIFICIAL RESPIRATION

MOST people think of artificial respiration for victims of drowning, gas poisoning and electric shock. Other conditions in which you may need to give it are: compression of the chest, as by the cave in of buildings, prolonged exposure to the cold, poisoning by sleeping medicines, excessive alcohol, hanging in attempted suicides, choking and puncture wounds of the chest.

Signs that the patient is being revived by artificial respiration are a fading of the bluish color of the skin and, in fair-skinned persons, a flush of color; twitching of the mouth and "creeping" of the fingertips; and, most encouraging, a sobbing catch of the breath while air is being taken into the lungs.



This picture shows the two 50ft masts, with the 30ft mast at the extreme right. Attached to the house is a 50-144 Mc beam.

HANGING YOUR SKY WIRE

Modern receivers are so sensitive that many people today do not bother to erect aerial masts and treat their sets to a good source of signal. But any set will do better with a good aerial, and for amateur transmitters, the aerial is a most important link in the chain.

OFTEN it is possible to make use of a high chimney or even a tree for the suspension of a good aerial, but more often than not at least one aerial mast is called for. It is the purpose of this article to talk about the erection of aerial masts, and to discuss some of the matters which must be considered when deciding on their height and location.

In general, the requirements for a transmitting aerial are more exacting than for receiving. In the latter case, most of the overseas broadcasting stations operating on short waves send out powerful signals, and many have found that even an indoor aerial will collect enough signal to give good results.

However, the improvement in signals brought about by a good outdoor aerial is the same for receiving as it is for transmitting, which is the reason why amateur transmitters invariably use the same aerial for both purposes. The remarks that follow, therefore, can be applied equally to both types of service.

MASTS VERSUS BEAM

When deciding to do something about improving results on the short waves, many amateurs consider the claims of a rotating, beam aerial, using parasitic elements, as opposed to the erection of a couple of high masts. If the beam can be supported at least a half-wavelength above ground at the wavelength concerned, there is much to be gained by the process. Unfortunately, it is not practicable to build such an aerial for any frequency lower than 14 Mc, and it is not normally possible to use such an aerial on more than one band. The work involved in building the tower and rotating mechanism is often beyond the facilities available to all but the more advanced experimenters.

A couple of 50ft masts, on the other hand, are not particularly hard to assemble and erect, and between them one can string all kinds of aerials on almost any band.

If they are more than 68ft apart, a half-wave can be managed on 7 Mc, and a whole string of colinear elements arranged for on the higher frequencies.

If a third mast can be placed to complete a triangle, three different broadside directions will be available, and the third mast need not be as high as the others.

FLEXIBILITY

This general plan was followed in the erection of masts at the writer's location recently, and it has worked out particularly well. The distance between any two of the masts is just over 70ft, and each of the 50ft masts carries a second halyard at the 30ft level. As the third mast is just over 30ft, six different aerials at two different levels are possible, enough to cover the whole gamut of amateur bands. These may be plain half-waves or, on the higher frequencies, a variety of directional types.

Apart from the flexibility allowed by the three masts, the 50ft level allows a low radiation angle to be achieved for covering long distances. Illustrating this, the lowest angle of radiation which can be achieved by a half-wave aerial strung half-wave above ground (under theoretically ideal conditions) is 30 degrees. This means that the signal we rely upon for distance work — that reflected from the ionosphere—comes to earth rather too close to home for best results.

As height is increased, the aerial pattern breaks up into a number of

"lobes," a couple of which begin to shoot out at about 10-15 degrees. At one wavelength above ground, we have two lobes at right angles to the wire on each side—one at this low angle and another at about 50 degrees. Thus, we have greatly improved the ability of the signals to skip over long distances, and at the same time retained some higher angle radiation which is useful, for instance, in interstate and local contacts.

The 50ft masts represent about ¾-wavelength at 14 Mc, giving two low angle lobes and a broad pattern at high angles. For all practical purposes, results are much the same as for a full wavelength.

At 28 Mc, another popular amateur band, the 50ft represents about 1½ wavelengths, at which height much the same general effect takes place, except that there are more lobes at both high and low angles. The 30ft level represents nearly one wavelength at this frequency, and once again we can expect useful low angle radiation.

For 7 Mc most transmission is over shorter paths up to about 500 miles, and the higher angle radiation brought about by the height of a little under a half-wave isn't going to be a disadvantage.

GOOD RESULTS

In practice, our results on 14 Mc with the high aerial have proved quite comparable with those of a beam aerial at about 30ft.

So that unless one erects a costly and complicated tower and beam carrying a number of aerials there is a good case for the masts if more than one band is used.

Beam aerials for the VHF bands of 50 Mc and higher are, generally speaking, not hard to arrange. Even here, bi-directional beam aerials can be erected at the 50ft height, if desired, which could easily outperform the conventional three-element types at a lesser height.

However, our main idea with the masts was for reception and transmission up to 28 Mc.

Not much information of a practical nature is available on the physical construction of masts for various heights. Our remarks made from practical experience, therefore, might provide some of the answers required by those following our example.

GUY WIRES

Not everybody can manage 50ft or more of mast. For them the rule would be to make the masts as high as possible and be satisfied with that. Thirty-five feet should be a practicable height almost anywhere.

Such a mast can be made of timber no heavier than 2 x 2 inches in one or two pieces. If made of clear, knot-free dressed oregon, or white pine, such a mast can be walked up by one strong man. We pushed ours up against a clothes-line post, lashed it to the post top with rope, and attached the guy wires to their prepared positions on the fences. Total time about 10 minutes.

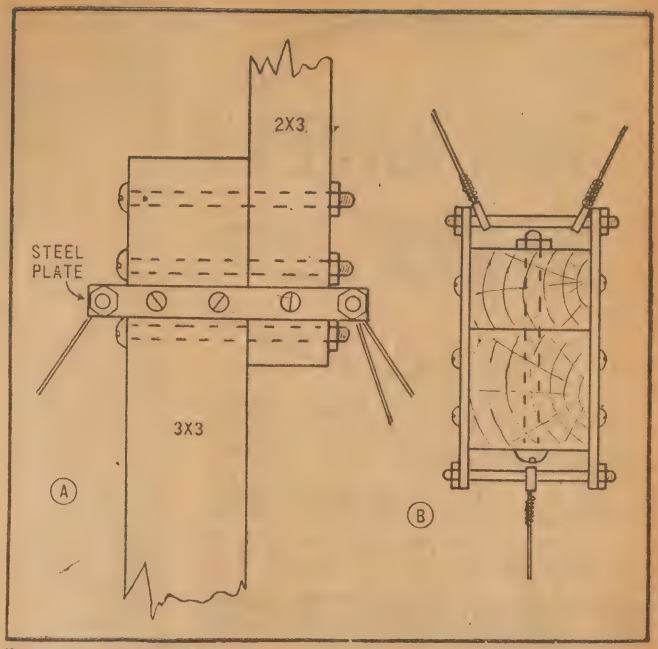
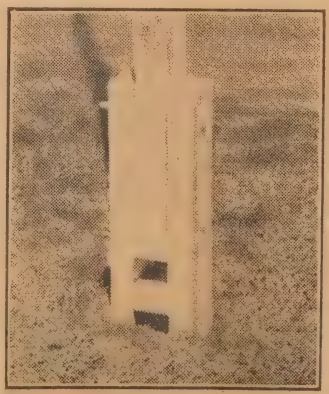


Diagram showing how side plates are attached at the 30ft level to carry guy wires. Our plates were one inch wide and 3/16in thick. A is side view, and B a plan view. Drawings are not to scale.

Only three guys are needed for a mast of this height. They can be single strands of 11 or 14 gauge galvanised wire running from the top. A better job would be to run the guys from about the 25ft level, with a fourth from the top to take the strain of the aerial. Anything over 35ft should have two sets of guys.

A mast between 35 and 45ft should be made of heavier timber. Two sections of 3 x 2 would be the minimum for this height, although one length of 25ft (2 x 3) bolted to a top section of 20ft (2 x 2) would be quite satisfactory with two sets of guys, one at the top and one at the join. Again, single 11 gauge wire would do for the guys.



Photograph of the cradle or tabernacle to which the base of the mast is mounted.

Anything over 45ft should be heavier still. Our masts used a 34ft bottom section of 3 x 3 and a 20ft top section of 2 x 2. Such a mast would be satisfactory carried to 55ft and even 60ft by extending the top piece, although for 60ft we would like to see 3 x 3 timber used throughout.

Because of the greater weight and wind resistance single strand wire should not be used for masts over about 40ft. We used galvanised clothes-line throughout for the guys, three from the top and three from the 30ft level. It would take a bulldozer to bring them down, which is just as well, because they would probably cut the house in half if they really tried!

PLANNING THE JOB

There are many ways of attaching the guys. We don't like threading them through holes in the masts. For the lower guys we clamped two steel side pieces across the overlap with two bolts, one each side of the mast, and screwed them to the masts with three screws on each side to make sure they couldn't slip down. Thimbles were slipped over the bolts before they were tightened, and the guy wires attached to the thimbles. Always use these thimbles when fastening guys.

At the top of the mast two wooden blocks were nailed and the guys were looped around the mast above them

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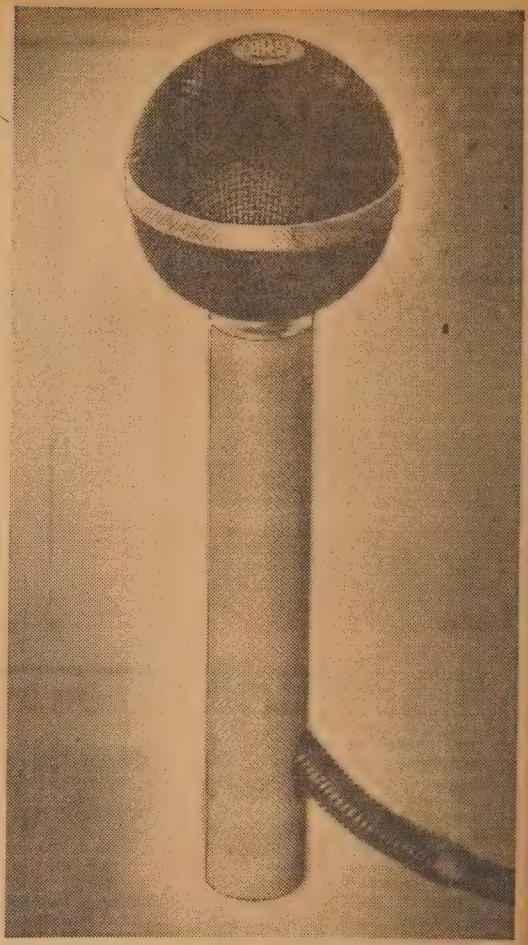

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so that they couldn't slip down. Never attach guys to screw-eyes screwed into the mast. It sounds silly, but it has been done. Sooner or later they will pull out.

The pulleys—good solid jobs which won't jam or rust—were attached to the mast top with three turns of 11 gauge wire wrapped around — some of the clothes-line would do. Never trust a pulley to a single strand of anything.

The secret in erecting a mast without tears is to plan everything on the ground. Before you decide on height select a spot for the mast which will allow firm attachment of guys at suitable distances from the base and, if possible, spaced so that no one will walk into them in the dark and decapitate themselves. Always try to have one set of guys immediately behind the pull of the aerial. Failing this, let the aerial pull equally between two of the guys.

Spend some time deciding on the placement of the masts. An amateur transmitter must also consider the type of aerial he intends to rely upon, its directional characteristics, and the position of the aerial with respect to them. Once in the air a big mast just can't be moved around at will.

Having selected the vital spots, a cradle or tabernacle should be made to anchor the bottom of the mast. This is made from two pieces of 4 x 2 hardwood, spaced the width of the mast by two blocks, one at the middle and one at the "bottom." The "top" is left open to take the mast.

This device should be about four feet long, with the bottom sunk into the ground for at least two feet. Left projecting will be a U-shaped cradle, the bottom of which will be the centre spacing block just clear of the ground.

BOTTOM ANCHORAGE

Before sinking the cradle two holes should be bored through the two side pieces and the bottom of the mast to take two half-inch steel bolts. Extreme care should be taken to keep these holes square with the woodwork to avoid the bolts assuming odd and awkward angles. It isn't hard with a suitable wood bit.

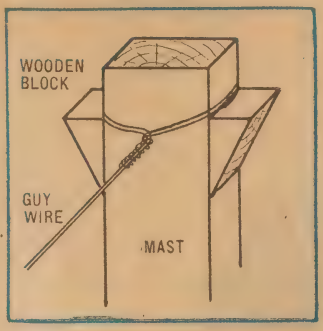
It should be done with the mast and cradle assembled on the ground before erection. The first hole is the hardest. When bored, a bolt can be slipped in place which will help to keep things lined up for the second hole. Lift the bit out of the hole at intervals while boring to avoid blocking the hole with chips and "sawdust."

Once having bored the two holes the cradle is buried and the earth solidly tamped down all round. A couple of bricks in the hole fore and aft will greatly strengthen the job. A bucket of concrete is even better. There is considerable strain on the cradle when the mast goes up, and it will be well settled in the ground.

The wood for the mast should be preferably of clean grained oregon, free from any large knots and without warps. White pine if obtainable is even better, but hardwood is useless. It's far too hard and heavy to handle and will twist and warp.

PAINTING

Lay the masts out on two or three boxes or other supports and paint them immediately either with linseed oil or a coat of paint. The oil is an excellent preparation for painting and is well worth while if the mast is to stand for a long time.



Two small blocks attached to the top of the mast prevent guy wires from slipping and avoid the need for boring holes.

If you allow rain and sun to reach the bare wood you can be sure the masts will develop splits which might well ruin them. Seal the surface right away with oil or paint.

Painting is very important to preserve the mast. At least three coats of good lead-based paint should be applied, well worked into any crevices and into the ends. The first two coats should be thinned out a little with turps or oil and allowed to dry thoroughly. The final coat or coats should be straight from the tin. As a rule the paint-maker has similar advice to offer.

After painting, the sections should be bolted together. Allow 2ft overlap for the 50ft mast and 3ft if the top section is longer than 20ft. Three quarter-inch bolts with washers should be used.

THE HALYARDS

Next comes the attachment of the guys and halyards. Take plenty of time to check that you have the guys correctly placed on the mast so that they will fall away cleanly when the mast is finally rigged. See also that the pulleys are on the right side. This seems elementary advice, but it can be most confusing to keep all these points in mind.

Theoretically it is a good thing to break up guy wires into non-resonant lengths, using insulators. Frankly, we didn't bother about it, and you please yourself. We haven't noticed any bad effects, and in many cases the wires will work out at non-resonant lengths, anyhow.

Paint all metal work before assembling to the mast, and after fixing in place paint it again. It's the only weapon you have against rust if you use steel, and we like steel, particularly for bolts.

The halliards are a bit of a problem. The best, of course, is flexible steel rope, except for the price! Next best is probably sash-cord of appropriate diameter. This should last a long time, but shrinks rather alarmingly when wet. To overcome this, at least one of the halliards is never tied down, but the aerial is kept taut by hanging a weight to it such as a brick. This can rise and fall as the cord shrinks. Failure to provide some such device will sooner or later cause the cord to break. It's an awful job to fit a new one, the only solution being to lower the mast.

HAULING UP

Up to 35ft erection can often be a one-man job. Up to 45ft two or three can manage it, but a team of half a dozen is best for the 50ft and over.

The technique is to place the mast in position, having sorted out all the guys so that nothing will tangle or kink on the way up. The bottom bolt is pushed through the mast and the cradle supports, to provide a hinge. Allow about an inch clearance between the bottom of the mast and the spacer block to avoid jambing on the way up.

Hauling into position is a matter of push and pull. Two of the team with a ladder supply the push, two more look after two guys pulled to the sides to keep the mast from swinging, and another takes the weight with a top guy as soon as the mast is high enough for him to do so.

Properly organised, the actual time taken in hauling up is only a few minutes, and all concerned must be prepared to work fast. As soon as the mast passes the 45 degree angle it suddenly appears to lose weight, and one of the pushers should be ready to run back with another of the top guys to stop the mast from overshooting its vertical position.

SPECIAL CASES

Once it is upright the second bolt at the cradle should be pushed into position and the lower set of guys brought to their anchor points one by one, if they are not already there. Often it isn't convenient to start off with them at their correct stations, as the mast may have to be pulled up at an odd angle to suit the layout of the ground.

Once the centre guys are OK the top guys are brought into their correct position and the mast lined up vertically.

One of our masts could not be laid on the ground but had first to be hauled up to rest on the house roof. This can often be an advantage, as it helps to overcome the job of pulling up that first 45 degrees. Take great care with such a process, as otherwise you can finish up minus a few tiles. A few bags on the roof guttering protects both the guttering and the mast.

The presence of an odd tree,

(Continued on Page 93)

KINGSLEY

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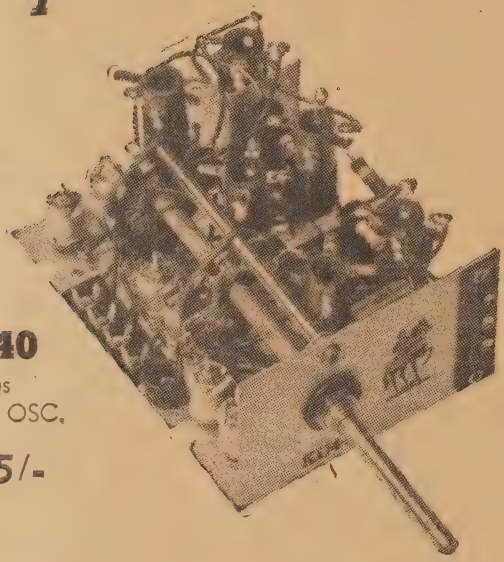
1



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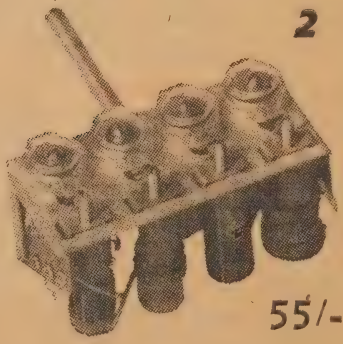

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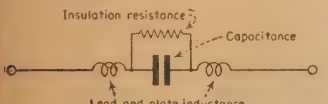
CHOOSE THE RIGHT CAPACITOR

This excellent article, prepared by Aerovox Engineers, sums up in concise fashion the types and characteristics of capacitors commonly used in radio equipment. Of particular interest is the mention of silvered mica and ceramic types, both of which are available now on the local market.

NO other electrical component is called upon to perform such a wide variety of functions in electronic circuits as the capacitor. Most of these applications are based upon the ability of the condenser to differentiate between electrical currents of various frequencies.

Such applications include: Dc blocking, ripple filtering, rf and audio by-passing, coupling, frequency determination, R-C timing, and energy storage. Because of the varied requirements of these uses, fixed capacitors are made in many types and sizes, each especially engineered to fulfil a specific application or function.



CAPACITOR EQUIVALENT CIRCUIT
FIG. 1

An important part of modern circuit design is, therefore, the choice of the proper capacitor for the circuit application at hand. In many cases, the success or failure of the design will actually depend upon this choice. The radio engineer, experimenter, and amateur must, therefore, have a firm background in capacitor design and application.

This article will review this material and point out certain important "kinks" in the use of fixed capacitors.

Probably the most direct route to a mastery of the "safe and sane" use of capacitors is to etsablish a thorough understanding of the characteristics and limitations of each general type. The choice of the proper type for each circuit application then becomes merely a matter of following good engineering practice.

BASIC TYPES

For this reason, we will commence with a discussion of the basic types of fixed capacitors which are encountered in electronic circuitry.

Since a capacitor is fundamentally two metallic conducting sheets isolated by a suitable dielectric material, the basic types are classified according to the type of dielectric used.

They include:
Air Dielectric Capacitors.
Mica Capacitors.
Ceramic Capacitors.
Paper Capacitors.
Electrolytic Capacitors.

Just as all inductances have distributed capacity and resistance, and everyday resistors have some inductance and "end-to-end" capacitance, practical condensers are not perfect capacitances.

All have a certain amount of residual inductance associated with the leads and plates, and also a finite value of resistance called the "insulation resistance." Thus, the equivalent circuit of any capacitor can be considered as in Fig. 1.

The magnitudes of these unwanted characteristics vary through wide limits as a function of mechanical design and type of insulation or "impregnant" used, and must be considered along with such other characteristics as capacitance value, voltage and current ratings, temperature coefficient, stability, &c., in selecting a condenser for a particular job.

A COMPROMISE

The actual choice is usually a compromise between mechanical and electrical perfection on one hand, and the dictates of economy, space, and the practical requirements of the application on the other.

From the standpoint of low losses (high capacitor) and constancy of capacity value, the most nearly ideal capacitors are built with air (or vacuum) as the dielectric between the plates.

IN radio parlance, "capacitor" and "condenser" mean the same thing. "Condenser" is the traditional term but "capacitor" is really the more modern and accurate one. Don't be surprised, therefore, if you find the older term being gradually eliminated from our articles.

Such capacitors are not perfect, however, for although air is a perfect dielectric, having zero power factor, some losses arise due to dielectric hysteresis in the insulating material used to support the plates. Charging currents flowing in the leads and plates cause additional power losses and give rise to some residual reactance.

The air-dielectric condenser occupies much more volume for a given capacitance and is usually more expensive than any of the other general types.

The reasons for this are apparent from an inspection of one of the simpler empirical formulas for the capacitance between parallel plates whose dimensions are large compared with the spacing between them, so that "fringing" may be neglected:

Capacitance (uufds) equals .2244 K.A/d,

Where:
K is the dielectric constant of the material between plates.
A is the area of the smallest plate. (Sq. In.)
d is the distance between the plates. (In.)

From this it is seen that the capacitance is directly proportional to the dielectric constant and the plate area, and inversely proportional to the spacing.

Since the dielectric constant of air is only 1.0, but it is greater than unity for all other insulating materials used in condenser construction, greater areas must be used in air capacitors to achieve a given capacitance.

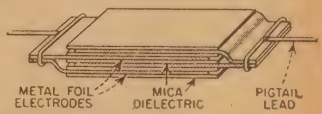
In addition, the dielectric strength of air is considerably lower than that of the other dielectrics, so that greater electrode spacings are necessary for a given working voltage. As a result, the volume occupied by an air-dielectric condenser will be at least 500 times greater than that of comparable capacitor using a high-grade mica dielectric.

LIMITED USE

Because of these factors, air as a dielectric is used only to a very limited extent in fixed capacitors, such as in certain laboratory capacitance standards. Fixed capacitors using vacuum or an inert gas under pressure are used to a greater extent, since the breakdown voltage is increased about four to ten times thereby.

Air dielectric variable capacitors are, of course, widely used for tuning r/f circuits because of their mechanical simplicity.

Mica is widely used as the insulating material in capacitors manufactured primarily for r/f applications. The mica capacitor is characterised by low-power factor ,high puncture voltage, good stability, high insulation resistance, and reasonable cost.



TYPICAL MICA CAPACITOR CONSTRUCTION
FIG. 2

As mentioned above, the size for a given capacity is considerably smaller than that of a comparable air-dielectric condenser. Due to the stacked construction usually employed, the inductance is quite low.

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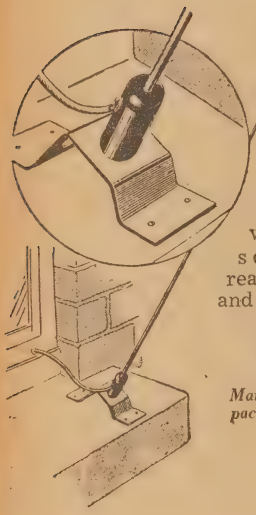

38/11

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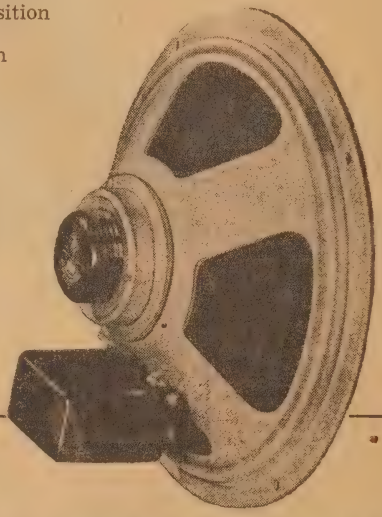
The Aegis Windowmount Aerial measures 4' 7" in length and comes in three sections of different diameter which screw together and if desired may be dismantled at the turn of the wrist.



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A common construction is illustrated in Fig. 2. The plates consist of metal foil sandwiched between thin sheets of mica dielectric material. The ends of alternate foil strips extend beyond the mica sheets at opposite ends of the stack and each group is clamped together and connected to a lead.

Thus, the charging currents which flow into each plate do so through a relatively short, broad path. Therefore, the inductance is low, being mainly that contributed by the wire leads.

Mica capacitors are used in a multitude of electronic applications where a high degree of capacitor excellence is required. Such uses include: R/f fixed tuner circuits, r/f by-passing, r/f coupling, d/c blocking, r/f neutralising, r/f filtering, a/f tone control, a/f degenerative feedback, a/f coupling where high insulation resistance is important (as in certain RC-coupled amplifiers), and many others.

DIELECTRIC HEATING

In radio frequency applications, mica capacitors are rated according to r/f current handling capability as well as maximum instantaneous voltage. The observance of both of these ratings is equally important in practice.

Excessive r/f current results in capacitor heating, which, in turn, causes increased dielectric losses, capacitance deviation, and lowered breakdown voltage. The effect is thus cumulative.

The r/f current through a capacitor in any given application can be determined by connecting a suitable r/f thermoammeter in series with it.

In applications where stability of capacitance value is important, as in tuned circuits, r/f filters, and other critical circuits, capacitors of the "silvered mica" variety are used. These units have extreme capacitance stability and low temperature coefficients. (The AEROVOX types 1464-1469-1479 have a positive temperature coefficient of only 30 parts per million per degree Centigrade.)

These excellent characteristics are obtained by depositing a silver coating on the opposite surfaces of mica wafers and "sintering" this assembly at high temperature to form highly conducting metal "plates" in intimate contact with the mica. The variable factor of stacking pressure is thus drastically reduced, with correspondingly improved stability.

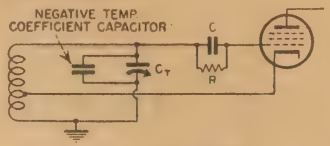
TEMPERATURE EFFECTS

High quality mica units are manufactured with either positive, zero, or negative temperature coefficients of capacitance. Capacitors of this type can be used for temperature compensation in tuned LC circuits in which low frequency drift with ambient temperature change is important.

By such means, self-excited r/f oscillators having frequency stability comparable to crystal controlled oscillators can be built. Stabilised oscillators of this type are used for receiver local oscillators, amateur vfo's, power oscillators where crystal control is impractical, &c.

An example of the application of temperature compensating mica capacitors is given in Fig. 3. Here it is desired to maintain the LC product (and hence the frequency) of an RF oscillator "tank" circuit at a constant value over a wide temperature range.

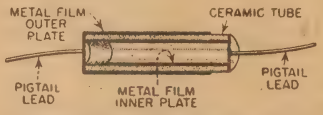
This may be accomplished by determining the approximate temperature coefficient of the uncompensated circuit in terms of capacitance deviation in parts per million per degree Centigrade. This coefficient will usually be positive with common circuit elements, i.e., the frequency decreases with increasing temperature.



USE OF TEMPERATURE COMPENSATING CAPACITOR
FIG. 3

Temperature compensation then consists of the selection of a capacitor having a negative temperature coefficient approximately equal to the positive characteristic of the other circuit elements. Thus, with all circuit elements subjected to the same ambient temperature changes, frequency "drift" is compensated.

A trick frequently resorted to by circuit designers consists of placing the compensating capacitor at a location in the equivalent where a temperature gradient exists, such as near a vacuum tube.



CERAMIC CAPACITOR CONSTRUCTION
FIG. 4

A "vernier control" of temperature compensation is then obtained by adjusting the position of the capacitor within this gradient by trial and error until a point of best frequency stability is located.

Another type of condenser which in some cases is comparable to the mica capacitor in electrical characteristics uses a ceramic as the dielectric material.

A typical design is shown in Fig. 4. The capacitor plates are deposited on the inner and outer surfaces of a ceramic tube with connecting leads at either end. This unit is then sealed in a second ceramic tube and the whole assembly is wax impregnated for moisture proofing.

CERAMIC CAPACITORS

Ceramic capacitors are manufactured in a wide variety of characteristics, depending upon the type of ceramic used for the tube upon which the electrodes are deposited. Since some of the ceramics have very high dielectric constants, the volume efficiency (micromicrofarads, cubic inch) is high.

Titanium dioxide ceramics, for instance, are used extensively for their high dielectric constants (90-170), low losses, and low temperature coefficients. Since the temperature coefficient can be controlled by the ceramic mixture, units ranging from essentially zero to high negative values of temperature coefficient are available for temperature compensation.

Due to the coaxial type of construction, tubular ceramic capacitors have low values of residual inductance.

One grade of ceramic capacitor is used interchangeably with mica capacitors in critical rf circuits, while a lower quality variety, which has very high volume efficiencies but poor stability, is used for general purpose applications such as by-passing.

Ceramic tubular capacitors are usually more expensive than equivalent mica units. However, disc type ceramic capacitors are less expensive than equivalent mica capacitors and are sold on a "guaranteed minimum value" basis.

DISC TYPES

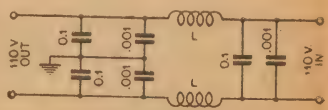
Disk ceramics are used in high frequency by-pass applications only.

Capacitors using wax or oil impregnated paper dielectric are employed extensively in d.c., audio, and low frequency r.f. applications, where high capacitance per unit volume and low cost is required.

They are characterised by generally poorer electrical characteristics than mica or ceramic capacitors, including: higher power factor, larger temperature coefficients, lower operating voltages, higher inductance and shorter life.

These factors depend to a larger extent upon the type of impregnant used, the purity of the impregnant, the method of construction, and the casing employed.

Wax is used as the impregnant in a large variety of utility capacitors for the lower voltage ratings, where small size and economy are important.



ILLUSTRATING USE OF DUAL BY-PASSING
FIG. 5

The tubular capacitors used in receiver audio, blocking, and by-pass work are examples. Moisture absorption shortens the life of cardboard-cased wax capacitors to some extent, as does high ambient temperature.

Castor oil, mineral oil, and chlorinated synthetic oils such as "askerels," are used in paper capacitors for higher operating voltages and greater dependability.

Mineral oil filled units have the best temperature characteristics and lower power factors, but are about 35 per cent larger in volume because of the lower dielectric constant. For this reason, castor oil filled condensers are used in most non-critical applications or where space is at a premium.

Typical paper condensers have

STANDARD -FERGUSON- RANGE

POWER & VIBRATOR TRANSFORMERS

	A.C.	Vib.				Retail
PF 123	240	6	220	40	6.3V @ 2A	33/6
PF 125	240	6	250	60	6.3V @ 2A	43/-
PF 119	240	6	325	125	6.3V @ 4A	62/-
PF 182	240	12	200	40	12.6V CT @ 1A	33/6
PF 126	240	12	250	60	12.6V CT @ 1A	47/6
PF 146	200,30,40,12		325	150	12.6V CT @ 2.5A	67/-

FILTER CHOKES

	Induct	D.C. Res.	M.A.		Retail
CF 100	50	1900	10		18/-
CF 101	30	870	25		18/-
CF 102	15	300	60		12/-
CF 103	30	420	60		26/-
CF 104	30	580	75		31/-
CF 105	15	250	80		24/-
CF 106	12	200	100		24/8
CF 107	30	360	100		34/8
CF 108	12	135	150		35/-
CF 109	20	225	150		37/8
CF 110	12	100	200		43/8
CF 111	16	165	200		45/10
CF 112	10	70	250		46/2

SPECIAL CHOKES

CF 113	.5	70	250		
	20		50	Swinging choke	50/6
CF 114	1.1	23	375	Ballast choke	24/-
CF 115	.017	.6	2 amps	L.T. choke	10/-

OUTPUT TRANSFORMER TO VOICE COIL

Full Frequency Range (30-15000)

Code No.	Pri. Imped.	Sec. Imped.	Watts	Retail
OP24	5000 SE	8.4, 2.1, with feed back	5	44/10
OP23	3250 SE	12.5, 8.4, 2.1	10	65/1
OP19A	5000 PP	12.5, 8.4, 2.3	15	102/10
OP51	4500 PP	15.5, 12.5, 8.6, 2.7, 2	20	36/9
OP63	10000 PP	15, 3.75	15	100/-
OP64	10000 PP	12.5, 3.125	15	100/-
OP65	10000 PP	8.4, 2.1	15	100/-

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Special Full Frequency (20-30,000)

OP25/40	10000 PP	40, 10	15	130/-
OP25/16	10000 PP	16, 4	15	130/-
OP25/15	10000 PP	15, 3.75	15	130/-
OP25/12	10000 PP	12, 3	15	130/-
OP25/10	10000 PP	10, 2.5	15	130/-
OP25/8.4	10000 PP	8.4, 2.1	15	130/-
OP66	5000 PP	8.4, 3.7	15	130/-
OP67	5000 PP	15, 6.5	15	130/-

OUTPUT TRANSFORMER TO LINE—

Full Freq. Range.

OP22	3250 SE	500, 125, 8.3	10	65/1
OP19b	5000 PP	500, 250, 125	15	102/10
OP21	8000 PP	500, 250, 125	15	82/10
OP62	10000 PP	500, 125	15	100/-

OUTPUT TRANSFORMER TO LINE—

Special Full Freq. Range

OP25/500	10000 PP	500, 125	15	130/-
OP25/250	10000 PP	250, 62.5	15	130/-

VIBRATOR TRANSFORMERS

Code No.	Pri. V.	D.C. Out.	MA	Buffer & Full Sec.		Retail
VT 100	6	200	40	.005	Sync.	27/-
VT 101	6	90	15	.008	"	19/6
VT 102	6	150	25	.005	"	23/10
VT 103	6	200	50	.005	"	25/-
VT 104	6	250	60	.005	"	37/-
VT 105	12	250	60	.005	"	37/-
VT 106	6	300	75	.008	"	52/-
VT 107	6	250	60	.005	Sync. Low Rad.	30/6
VT 108	12, 90		15	.008	Sync.	21/8
VT 109	24, 90		15	.008	"	23/8
VT 110	12	150	25	.005	"	23/10
VT 111	24	150	25	.005	"	26/6
VT 112	12	200	50	.005	"	25/-
VT 113	24	200	50	.005	"	26/6
VT 114	12	300	75	.008	"	54/2
VT 115	24	300	75	.008	"	55/6
VT 116	24	250	60	.005	"	30/-
VT 117	12	250	60	.005	Non Sync. Low Rad.	31/-
VT 119	32	150	25	.005	Sync.	25/6
VT 121	6	180	30	.005	"	25/6
VT 122	6	400	50	.005	"	50/-
VT 123	12	320	125	.005	Sync.	63/3
VT 124	32	250	60	.005	"	30/-
VT 127	6	200	50	.005	Sync. Low Rad.	29/8
VT 128	12	250	60	.005	Sync. Low Rad.	38/-

RECEIVER POWER TRANSFORMERS

Code No.	Prim.	HTV Aside	M.A.	Filaments	Retail
PF 185	240	150	30	6.3V @ 2A	24/-
PF 106	240,325		45	6.3V @ 2A, 5V @ 2A	30/-
PF 198	240	285	50	6.3V @ 2A, 5V @ 2A	30/-
PF 151	200,30,40	285	60	6.3V @ 2A, 5V @ 2A	34/-
PF 165	200,30,40	385	60	6.3V @ 2A, 5V @ 2A	34/-
PF 170	200,30,40	285	80	6.3V @ 2A, 6.3V @ 2A, 5V @ 2A	39/10
PF 168	200,30,40	385	80	6.3V @ 2A, 6.3V @ 2A, 5V @ 2A	39/10
PF 130	200,30,40	285	100	6.3CT @ 2A, 6.3V @ 2A, 5V @ 2A	46/-
PF 160	200,20,40	385	100	6.3CT @ 2.5A, 6.3V @ 2A, 5V @ 2A	46/-
PF 152	200,30,40	285	125	6.3CT @ 3A, 6.3V @ 2A, 5V @ 2A	56/-
PF 181	200,30,40	385	125	6.3CT @ 3A, 6.3V @ 3A, 5V @ 2A	66/-
PF 174	200,30,40	285	150	6.3CT @ 2A, 6.3V @ 2A, 5V @ 2A	60/-
PF 175	200,30,40	385	150	6.3CT @ 2A, 6.3V @ 2A, 5V @ 3A	70/-
PF 173	200,30,40	425	175	6.3CT @ 3A, 6.3V @ 2A, 5V @ 3A	110/-
PF 140	200,30,40	385	200	6.3CT @ 3A, 6.3V @ 3A, 5V @ 3A	111/-
PF 171	200,30,40	385	250	6.3CT @ 4A, 6.3 @ 3A, 5V @ 3A	144/-
PF 201	240		225	50 6.3 @ 2A	29/11

LINE TO VOICE COIL TRANSFORMERS

	Pri. Imped.	Sec. Imped.	Watts	Retail
MT111	500	12.5, 8, 2.3	10	36/9
MT100	600	4, 3	15	36/9
MT101	500	15	15	36/9
MT124	600, 500	4, 3, 2.7, 2.3, 2	25	66/-
MT125	600, 500	15, 12.5, 8.4, 6.5	25	66/-

MODULATION TRANSFORMERS

MT118	8000, 6000 PP	10000, 7000 5000	25	85/-
MT119	8000, 6600, 3800 PP	10000, 7500, 6500 5500, 4500, 3500	50	111/-
MT120	500 to 20000 in steps.	500 to 30000 in steps.	50	200/-
MT121	500 to 20000 in steps.	500 to 30000 in steps.	125	276/-

Output Transformer To Voice Coil—P.A. Range

	Pri. Imped.	Sec. Imped.	Watts	Retail
OP1	5000, 2500 SE	12.5, 8, 2.3	10	39/10
OP54	5000, 2500 SE	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	10	45/8
OP39	5000, 2500 SE	15	10	39/10
OP33	5000, 2500 SE	5, 2.7	10	39/10
OP41	5500 SE	3.7	10	46/-
OP53	30000, 20000 14000, 10000, 7000 5000, 2500 PP	2.3	10	36/9
OP2	5000 PP	12.5, 8, 2.3	15	65/1
OP55	5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/10
OP3	6600 PP	12.5, 8, 2.3	15	65/1
OP56	6600 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/10
OP4	10000 PP	12.5, 8, 2.3	15	65/1
OP57	10000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/10
OP5	10000, 6600, 5000 PP	12.5, 8, 2.3	15	65/1
OP58	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	76/2
OP59	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	25	93/8
OP60	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	32	116/8

OUTPUT TRANSFORMER TO LINE—P.A. Range

	Pri. Imped.	Sec. Imped.	Watts	Retail
OP1A	5000, 2500 SE	500	10	39/10
OP44	5000, 2500 PP	500, 250, 125	10	47/-
OP34	5000 PP	600, 300, 200, 150, 130, 100, 75, 50	15	81/4
OP6	3000 PP	500, 250, 125	15	65/1
OP7	6600 PP	500, 250, 125	15	65/1
OP50	8000 PP	600, 300, 120, 60, 30	15	126/-
OP8	10000 PP	500, 250, 125	15	65/1
OP8M	10000 PP	500, 250, 160, 125, 100, 83.5, 71.5, 62.5, 55.5, 50	15	71/3
OP9	10000, 6600, 5000 PP	500, 250, 125	15	65/1
OP10	5000 PP	500, 250, 125	25	81/10
OP11	6600 PP	500, 250, 125	25	81/10
OP38	6600 PP	600, 300, 250, 200, 170, 150, 76, 50, 36, 27, 12.5, 7.5, 3.6, 2.7	25	140/-
OP12	10000 PP	500, 250, 125	25	81/10
OP13	10000, 6600, 5000 PP	500, 250, 125	25	81/10
OP35	10000, 6600 PP	500, 4000, 3.4, 2.2	25	120/-
OP14	5000 PP	500, 250, 125.	32	102/10
OP48	6600 PP	140, 70.	32	117/8
OP15	6600 PP	500, 250, 125	32	102/10
OP15M	6600 PP	500, 250, 166, 125, 100, 83.5, 71.5, 62.5, 55.5, 50	32	104/1
OP16	10000 PP	500, 250, 125	32	102/10
OP17	10000, 6600, 5000 PP	500, 250, 125	32	102/10
OP36	3800 PP	17.6	60	108/7
OP18	3800 PP	500, 250, 125	60	108/7
OP61	3800 PP	100, 75, 25, 10, 5, 3	60	133/8
OP27	6400 PP	500, 250, 125	80	150/8
OP49	8800, 6000 PP	500	105	210/-
OP20	11600, 8400 PP	500, 250, 125	150	276/-

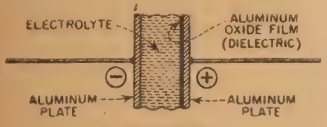
ALL PRICES SUBJECT TO ALTERATION WITHOUT NOTICE.

temperature coefficients of capacitance approximately ten times larger than high grade mica capacitors, such as the silvered-mica types.

Power factors are greater by at least one order of magnitude and inductances are larger, especially in the types using paper-foil rolled construction, in which the contact tabs are at the ends of the rolled foil plates.

In paper capacitors of advanced design, residual inductance is minimised by the use of the extended electrode construction, in which electrical contact is made at the edges of the rolled electrodes, so that charging-current paths are short.

In applications where a wide range of frequencies must be effectively by-passed, as in the TV line filter shown in Fig. 5, a high capacitance paper capacitor may be used in parallel with a small mica unit. Otherwise, the residual inductance of the paper condenser may make it ineffective as a by-pass for the high r.f. frequencies.



ELEMENTARY ELECTROLYTIC CAPACITOR
FIG. 6

Another by-passing device used in video i.f. amplifier design consists of using capacitors which are self-resonant at the frequency to be by-passed. A value of capacitance is chosen which is series resonant with the inherent inductance of the capacitor and its leads. This type of single-frequency by-passing is very effective.

The familiar electrolytic capacitor is the "work horse" of the receiver power supply filter field. These units have extremely high volume efficiencies, occupying only about 15 per cent of the space required for equivalent paper capacitors. The cost per microfarad is also very low.

ELECTROLYTICS

For these reasons, although inferior in most other respects to the other types, the electrolytic capacitor is extensively used for filter and by-pass applications.

An electrolytic capacitor may be made either by immersing two aluminium electrodes in an electrolytic solution, such as ammonium borate or sodium phosphate (a "wet" electrolytic), or by filling the space between rolled foil electrodes with a thick paste of similar material (the "dry" electrolytic).

A "forming voltage" applied between the plates deposits a film of aluminium oxide on the positive plate. See Fig. 6. This film is the dielectric material of the capacitor. Because it is extremely thin—being only .000025 inch thick in some cases—the capacitance per unit area is very high.

For the same reason, the operating voltage of the unit is limited to about 450 volts. Electrolytics may, however, be used in series for higher voltages with the use of the usual voltage equalising resistors shunting each unit, as must be used with mica and paper capacitors which have higher insulation resistances.

The electrolytic condenser is essentially for d.c. applications, since to maintain the oxide film, the plate bearing it must never become negative. If a.c. components are present, they must be smaller in voltage than the steady d.c. voltage impressed.

The high leakage current of the electrolytic becomes much greater after prolonged inactivity, but soon drops to a normal value of about 200 microamperes per microfarad.

The wet electrolytic has been used in voltage limiting applications because of its particularly steep leakage-current versus applied voltage characteristic.

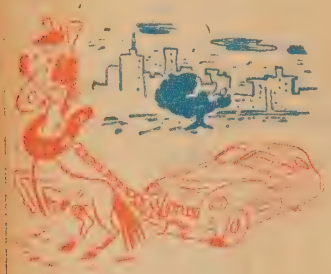
Illuminated antenna for automobiles, recently patented, has a small electric bulb at the top which is energised from the car's storage battery. The electrical connection are such that they do not interfere with the radio-reception function of the antenna.

Here's your answer, Tom!

Tom has achieved an almost unique reputation for schizophrenia—or split personality. In the past he has been everything from a schoolboy to a retired doctor, from a truck driver to a schoolteacher. This month he is no less diverse a character but his questions are made all the more interesting by their variety.

BEFORE answering any more queries, we must plead guilty to leading Tom astray in the January issue, when we suggested that electrolytic condensers were used to filter the 50-cycle power mains. What we actually meant to infer, of course, was that the condensers are used to filter power derived from the mains after it has passed through the usual power transformer and rectifier.

We must confess that it would be futile occupation wiring electrolytics across the powerline. The mortality rate might be rather high among fuses, electrolytics—and personnel!



A "horsepower" cart

While on the subject of condensers, some technical "longhair" friends have reminded us that there is really no longer any such animal as a radio condenser." The accepted term is now "capacitor." Henceforth we will talk about capacitors—whenever we remember it.

All this brings us to Tom's first question which arises from the same January issue. He is quite happy about mica, paper, and electrolytic capacitors, but he would like to know:—

What is a "picrofarad" capacitor?

Well, Tom, that's something like asking what is a horsepower car. You see, the picrofarad is simply a unit of capacitance. It is derived from the farad, which is a large unit and much too clumsy for radio work.

For instance, a 100-picrofarad (pf) capacitor is frequently used in radio work. A picrofarad is one million-millionth part of a farad, so that the same capacitor could be designated 100/1,000,000,000,000 farads. Personally, we think it's much easier to say 100 pf. Easier even than saying 100 micromicrofarad (100 mmfd), which means the same thing.

The usual thing is to use picrofarads up to 999 pf, and microfarads from then on. For example, a 1000 pf capacitor is the same thing as a .001 mfd capacitor, for a microfarad is equal to a million picrofarads. About the largest capacitor you are likely to strike in radio work for some time is 100 mfd. In practice the basic unit, the farad, is very seldom used.

What are negative and zero temperature coefficient capacitors?

This is a question that will not concern you greatly until you graduate into the realm of transmitters, communication receivers, frequency meters, &c., but the principles involved are easy to understand.

A zero temperature coefficient is so designed that its capacitance remains constant throughout a fairly large temperature range, while a negative temperature coefficient condenser decreases in capacitance with increase in temperature. In the latter case the capacitance variation with temperature is usually stated as so many pf per degree centigrade.

TOTAL CAPACITANCE

The capacitance across a tuned circuit is made up of, say, a tuning capacitor, a trimmer capacitor, and the input capacitance of a valve. In most cases the temperature coefficient of this combination will be slightly positive. If the correct amount of negative temperature coefficient capacity is added, it will be possible to make the total capacitance independent of temperature.

In practice, the usual procedure is to determine by experiment the amount of negative coefficient capacitance required.

On the November "Reader Built It" page you publish the circuit of a one-valve battery set, commenting that it would bee preferable to have the switch in the positive low tension lead rather than the common negative lead. Why is this?

The main reason is that we do not like to see the valve manufacturers pay too much income tax! You see, if the B-battery positive terminal, or any part of the high tension circuit, is accidentally shorted to earth, with the switch in the "off" position, almost the full high tension voltage will appear across the valve filament, with obvious results.

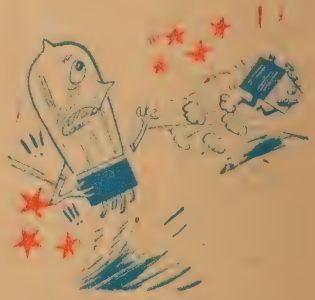
THE CIRCUIT

The circuit isn't difficult to trace if you remember that the positive A and B battery terminals are common. Therefore, with the positive terminal of the B battery earthed it is connected to one side of the filament, which is also earthed. The other side of the circuit is completed through the A battery, which is connected to the remaining filament terminal.

The potential of the A battery is in opposition to the B battery, but since the A battery is a mere 1.5 volts, opposing 67.5 volts, the net result is a blown filament.

Remember, all you need to do to set this fiendish circuit into operation is to flick the headphone terminals against the chassis.

I wish to use a potentiometer with a single pole switch as a combined volume control on/off switch. Would it be okay to put the switch in the common negative lead, provided I include a fuse in the B-battery minus lead?



You're trying hard, Tom, but you're only begging the question. If the filament circuit only draws 50 or 100 mA, it would have to be a pretty fine fuse to "blow" reliably before the filament, which it's supposed to protect.

The real point of the matter is that there is nothing in favor of the suggested position for the switch. It can't save the B batteries from residual drain, because it can't really break

the B-battery circuit. Leakage current can still flow via the filaments.

If there's only one pole on the switch it can only break one circuit and that'd better be the filament circuit.

If the design of the set is such that there is a continuous drain on the high-tension supply, such as a potentiometer for the reaction control, the only solution is to use a double-pole switch and to break both battery connections separately.

What is the difference between 1st, 2nd and 3rd IF transformers?

Part of the question we can dispose of very easily, Tom. If you buy a set of transformers labelled 1st, 2nd and 3rd—and they are part of a complete set—then you can assume that they are all low-gain types intended for use in a two-stage IF channel.

TWO TRANSFORMERS

This is a rather special case, however, because most sets these days use only two IF tranformers and they are used in pairs—just the 1st and the 2nd. What's more, the 1st and 2nd of a pair are likely to be quite different from the counterparts in a set of three transformers.

But as for the difference between the ordinary 1st and 2nd IF, we wouldn't like to hold a brief. In some cases the only real difference is the mark on the can or a hole in the top for an outgoing grid lead.

Ideally, the 2nd IF could be wound to match into the impedance of the usual diode circuit, but this is not always done, for economic reasons.

There doesn't seem to be very much more to say right here. If you want to go into the matter more deeply, Tom, have a look at the article on coils in the December issue.

Would you please enlighten me as to how to measure volts, coils, &c.?

Well, Tom, take a ruler firmly in the right hand—sorry—perhaps you would like some "dope" on using a multimeter.

First of all, most multimeters have provision for reading voltage, current and resistance in a DC sense, while some also make provision for reading AC voltages. The various ranges may be selected either by pin-jacks or a switch.

VOLTAGE READING

Let's take the DC voltage readings first. Say, for instance, you wish to check a 1.5 volt torch cell. Adjust the instrument for the 10 volt DC range, since this is the nearest above the expected reading, and apply the negative test prod to the negative terminal of the battery, and the positive prod to the positive terminal.

If the battery is in new condition you can expect to read about 1.6 volts on the 10 volt scale; that is, a little less than a sixth of full scale. Throughout the life of the battery the terminal voltage will gradually drop until it will read about 1.1 volts when fully exhausted. In a similar way you can check a 45 volt battery using the 50 volt scale.

When checking batteries you always have a fair idea of the reading to expect. However, when reading voltages in a receiver, there may be some doubt, and it is always wise to start off with a high scale and work down. If you wish to check the high tension voltage, use the 1000 volt scale first and, if it is obvious that the reading is below 250 volts, switch to the 250 volt scale, where you can obtain a more accurate reading. The scales on your multimeter may be different from the examples used, but the same principles still apply.

LOW VALUES

Only experience will teach you what readings to expect under various circumstances.

Beginners are very often puzzled by the low readings obtained at the plates and screens of resistance-coupled amplifiers. This is due to the fact that the meter takes current from the circuit, and the true voltage is often much greater than that shown by the meter. The only solution is to use a vacuum tube voltmeter or arrive at the reading by calculation after reading the current and resistance in the circuit.

To use the current scales it is necessary to break the circuit and insert the meter.

For instance, if you wish to check the plate current of a 6V6-G output valve, lift off the plate lead and, after adjusting the instrument to the 250 mA range, connect the negative lead to the plate-pin and the positive test lead to the lead from the output transformer.

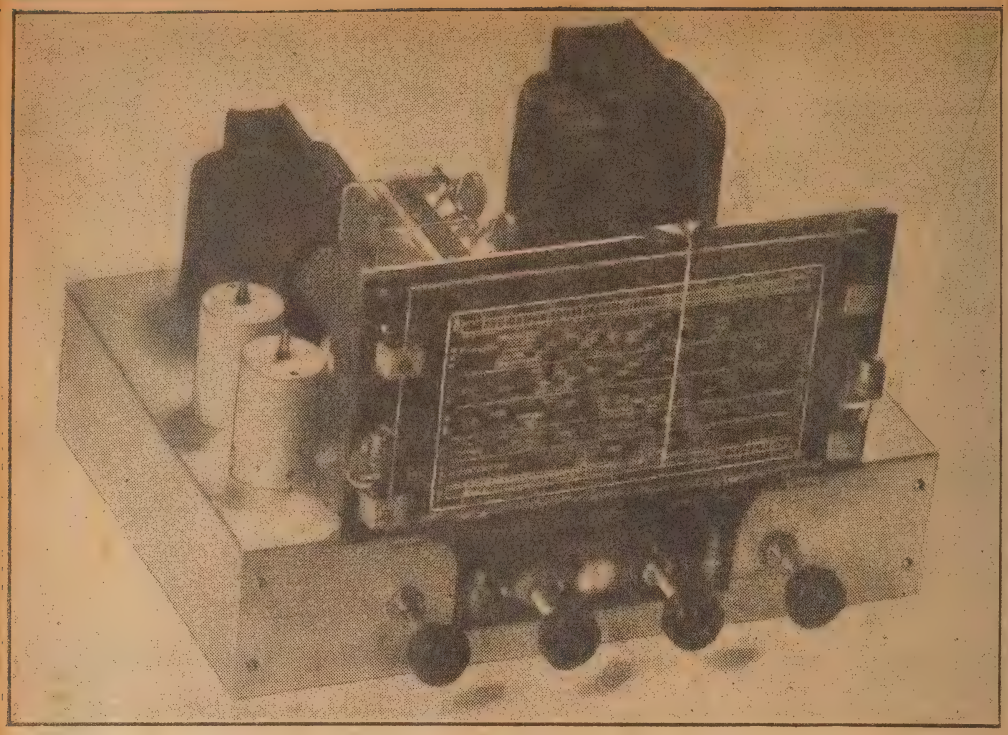
If the reading is below 50 mA, you can use the 50 mA scale for a more accurate reading. Always switch the set off while making adjustments, both to avoid the danger of shock and to prevent damage to the gear.

CURRENT RANGES

Remember that the meter is virtually a short circuit when switched to the current ranges, and you must be very careful not to overload either the meter or the circuit being measured. For instance, you would certainly never use a milliampmeter to test a battery, although you could measure the current the battery is delivering to an external circuit, provided it is within the range of the meter.

The resistance scales may be used for checking resistors, coils, transformers, chokes, &c., for continuity. If a condenser is shorted, this can also be checked.

With most instruments the procedure is to first of all switch to the desired range, short the test prods and adjust the ohms scale zero knob until the meter reads exactly full scale. Then apply the unknown resistance to the terminals of the meter, and the needle will read something less than full scale, depending on the value of the resistance. The value is read from the special ohms scale.



From left to right the controls are Volume, Tuning, Ganged Switch, and the combined tone/selectivity switch.

THE R & H 1951 ADVANCE

The name "Advance" has been reserved over the years for sets which have represented the latest and best in 5-valve domestic superhets. This new addition to the line uses miniature high-gain tubes throughout, provides for extended range reception and is well suited for use as a radiogram. A magic eye can also be fitted if you want it.

by Raymond Howe

LARGER and smaller sets notwithstanding, the 4/5 superhet has long been established as the favorite for general broadcast listening. Quite a few have been described in these columns over the past years, necessarily following a more or less stereotyped pattern.

This set, however, is new from stem to stern. It is built around the miniature series of valves and takes advantage of the high gain of which these types are capable.

Although we are mindful, when treating a new design, to keep the number of standard chassis to a minimum, it was obviously impossible to avoid a new chassis design in this set not only because of the miniature type valves but also in view of the switching associated with the variable selectivity.

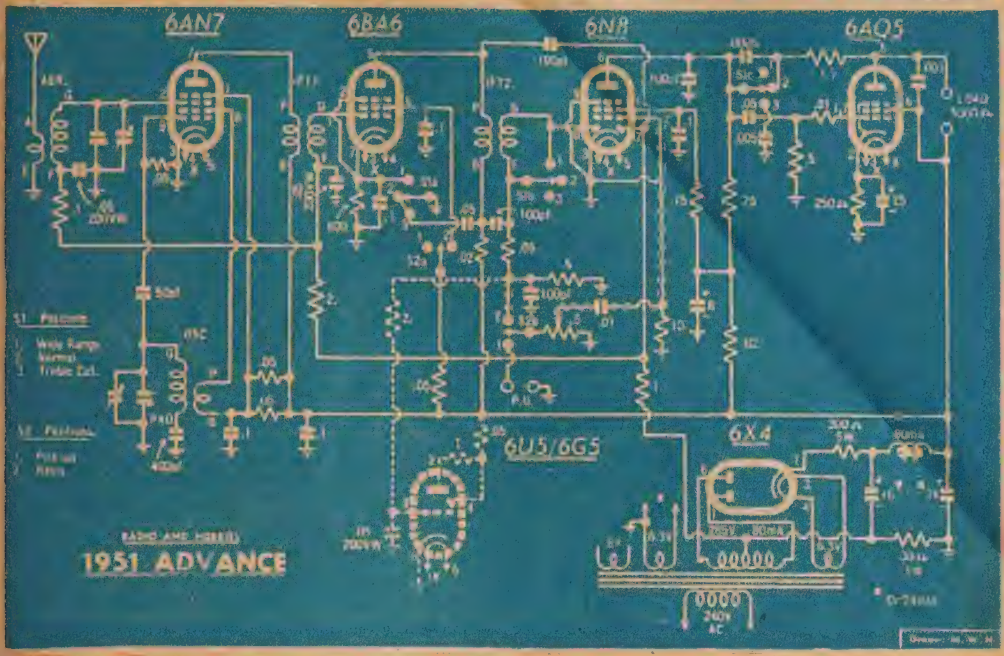
In this latter connection, we wanted to arrange the IF channel along the front edge of the chassis to avoid the use of brackets, bearings and an extension shaft which would be required if this portion of the circuitry were arranged elsewhere on the chassis.

Nevertheless, the general layout, as dictated by this requirement, resolves into a neat and very efficient one.

The rear chassis view shows how the RF end feeds into the IF and thence to the audio in logical sequence from one side of the chassis to the other. The power supply takes up the rear half of the chassis while the rear face of the chassis carries the aerial and earth terminals, the pick-up terminals, the speaker socket and the power cord inlet.

Treating the electrical design of the circuit on a step-by-step basis, the 9-pin 6AN7 triode-hexode was

CIRCUIT DIAGRAM OF THE 1951 ADVANCE



The circuit uses miniature valves throughout. A distinctive feature is the combined tone and selectivity switch which gives a three positions: Wide range, Normal, Treble cut.

chosen as the converted both for its high conversion transductance and the fact that it can be used with a standard oscillator coil. The circuitry of this stage therefore follows standard practice.

The rated no-signal screen voltage of 85 volts is employed and, to avoid the need for an extra resistor and capacitor combination, the oscillator triode anode is operated at this voltage instead of the usual 100 volts. The comparaitvely high oscillator transconductance permits this to be done.

In no way does it detract from oscillator performance, as indicated by the amount of oscillator grid current read over the tuning range.

THE PADDER

A point worthy of mention here is the value of the padding capacitor. In recent years we have standardised on the use of a fixed capacitor in this position, necessary adjustment for tracking being made with the variable slug in the oscillator coil.

There is nothing wrong with this approach provided that the actual value of the padding capacitor is within the 400-425 pf range. However, such may not always be the case, some condensers varying considerably from the marked value.

To overcome this difficulty, one coil manufacturer adopted the process of adjusting the oscillator coil inductance at the factory and stipulating the use of a variable padding capacitor. This scheme has its merits where the oscillator coil inductance has previously been set to the required value at a factory. Of course, some advanced constructors are in a position to set the oscillator inductor slug themselves by making trial runs on the tracking for different settings.

With small variations from the marked value of the padding capacitor, good tracking can be obtained with sligth readjustment to an oscillator coil which has previously been set. Where the padding capacitor appears to be considerably low in value, the paralleling of small value capacitor will allow the tracking to be brought

PARTS LIST

1 Chassis 12½" x 9" x 2¾"
1 Power transformer 285V per side at 80 mA, 6.3V 2A, 5V 2A.
1 80 mA filter choke.
1 2-section gang tuning capacitor (AWA or Stromberg H).
1 Dial to suit (USL32 or similar).
1 Broadcast aerial coil, 1 broadcast oscillator coil.
2 Standard 455 kc IF transformers, Nos. 1 and 2.
2 gang trimming capacitors.
2 9-pin "noval" sockets, 2 7-pin miniature valve sockets, 1 7-pin miniature socket with shield.
1 4-pin miniature plug and socket.
1 3-pole, 3-position, single bank wafer switch.
1 2-pole, 2-position, single bank wafer switch.

VALVES

1 6AN7, 1 6BA6, 1 6N8, 1 6AQ5, 1 6X4.

CAPACITORS

1 25mfd 40PV electrolytic, 2 16 mfd 525PV electrolytics, 1 8mfd 525PV electrolytic, 4 .1 mfd 400VW, 1 .1 mfd 200VW, 2 .05 mfd 400VW, 3 .05 mfd 200VW, 1 .01 mfd, 1 .005 mfd, 1 .001 mfd, 1 400pf mica (low tolerance) 4 100pf mica, 1 500pf mica.

RESISTORS

1 10 meg. ½w, 2 2 meg. ½w, 1 1.5 meg. ½w, 1 1 meg. 1w, 1 meg. ½w.
1 .75 meg. 1w, 2.5 meg. ½w, 1.5 meg potentiometer, 1 .1 meg. ½w.
4 .05 meg. 1w, 2 .05 meg. ½w, 1 .02 meg. 1w, 1 .01 meg. ½w, 1 600 ohm ½ or 1w, 1 300 ohm 5w, 1 250 ohm 1w, 1 30 ohm 1w.

SUNDRIES

4 knobs, 4 terminals (2 red, 2 black), 2 1" tapped insulating pillars 2 5-tag mounting strips, 3 3-tag mounting strips, 1 2-tag mounting strips, power flex and plug, approx. 12" shielded hook-up wire, approx. 15" PTIM coaxial cable, nuts and bolts, spaghetti, hook-up wire, solder, solder lugs, etc.

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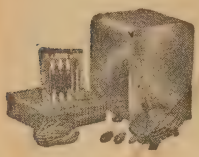

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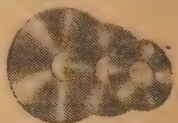

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"on the nose" with but a slight adjustment of the oscillator "slug."

To summarise, the story would be something like this. Where the oscillator "slug" has been preset and sealed, instal a variable padding capacitor and use it for the tracking adjustment. Where the oscillator "slug" has not been preset, try to obtain a 5 per cent tolerance condenser of 400 or 425 pf and adjust the oscillator "slug" for the tracking adjustment.

In the IF stage, the 6BA6 miniature button-based type is used because its comparatively high transconductance allows us to "do things" in the IF channel without having to worry about losing too much overall gain.

VARIABLE SELECTIVITY

It is in this stage, or actually between this stage and the next one, that one of the main features of this set is incorporated. The story of variable selectivity as applied to R & H designs for broadcast receivers is not new to our readers. It has been presented twice before, in the "Band-spread Six" and the "Fidelity Five" receivers.

The basis of the feature is to substitute resistance-capacitance coupling between the stages for the normal inductive coupling. The result of this change is to reduce the selectivity of the IF channel and thus widen the acceptance band of the whole receiver.

Without going into the technical pros and cons, this means that improved fidelity can be obtained from local radio programmes, the effect showing up much better on recordings and live-artist shows.

The change in reproduction when moving from the "normal" position of the selector switch to the "extended range" position is readily noticeable on most programmes, being really worthwhile on live artist programmes and when feeding into a wide range speaker.

Unfortunately it suffers the disadvantage of all extended-range systems in that it makes very obvious the harshness of records which may suffer from distortion or unwise compensation at the transmitting end.

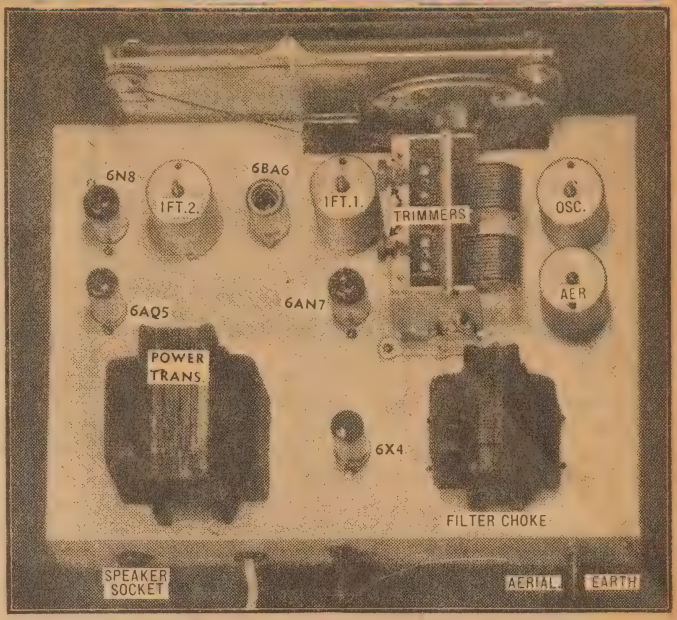
OTHER POSITIONS

However, there is a ready cure for all this and the selector provides an even variation in tonal range as it is rotated through the three positions.

Electrically, the broad-band effect involves a drop in the interstage coupling gain, but, as already mentioned, this has been anticipated by the deliberate choice of a high-gain valve in the IF amplifier stage. The change from normal to extended range is accompanied by a change in the standing bias on the IF amplifier, which tends to keep the overall gain more nearly constant.

In practice, this provision, together with normal AVC action, largely obviates any change in volume as the switch is operated.

REAR VIEW OF THE CHASSIS



Novel feature of the layout, seen from the rear is the off-centre position of the tuning gang. Care is necessary to position the drum so that the cord maintains a straight run and remains clear of the dial plate.

All this can be readily seen by following the action of the selector switch. In position 1 section S1a shorts out the cathode bias for the 6BA6, while section S1b shorts out the diode winding of the No. 2 IF transformer. The condenser bypassing the lower end of the IFT2 primary is simultaneously deprived of its earth return path.

BIAS CONDITIONS

Thus the 6BA6 is operating with a minimum standing bias of two volts from the AVC line, and in this condition the no-signal screen voltage has been arranged at 100 volts. Curves for this valve type show that, in these circumstances, the operating Gm is of the order of 3000—quite a healthy figure.

Resistor Color Code

VALUE	BODY	END	DOT
10 megohm	Brown	Black	Blue
2 megohm	Red	Black	Green
1.5 megohm	Brown	Green	Green
1 megohm	Brown	Black	Green
.75 megohm	Violet	Green	Yellow
.5 megohm	Green	Black	Yellow
.1 megohm	Brown	Black	Yellow
.05 megohm	Green	Black	Orange
.02 megohm	Red	Black	Orange
.01 megohm	Brown	Black	Orange
600 ohms	Blue	Black	Brown
250 ohms	Red	Green	Brown
30 ohms	Orange	Black	Black

The plate load for the 6BA6 is provided by the IFT primary and a series-connected 20,000 ohm resistor, the two forming a circuit which is much broader than would be the IFT winding alone. Actually, the broadening effect would be greater with the winding shorted out, but since this would have entailed an extra deck on the switch and a greater loss of gain we finally decided against it. The possibility is mentioned, however, for those who like to experiment.

The secondary winding is shorted in any case and this obviates the normal magnetic coupling across the transformer. Instead, the coupling is by means of capacitance, deliberate and otherwise, between the primary and secondary circuits, so that the diode is substantially R/C coupled.

SELECTIVITY

In essence, the switching removes two of the five tuned circuits which operate on the signal and gives a degree of selectivity midway between the average TRF and the average superhet.

In positions 2 and 3 of sections S1a and S1b, the normal inductive coupling is in circuit between the stages and the selectivity is the same as in the usual run of single IF stage superhets. The .02 Megohm resistor and the .05 mfd capacitor then merely form a decoupling network for the HT feed to this stage.

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14/60 Filter Choke Type TC66
14/60 Filter Choke replacement winding Type F170.

Remember R.C.S. now has a completely redesigned range of Transformers and Chokes

R.C.S. have redesigned the complete range of transformers and chokes, the most noticeable features being the former which is now moulded from high melting point polystyrene powder (so that solder tags will not melt out) and completing the component with an aluminium bracket.

FILTER CHOKES

TC60 100 M/A 30 Henries 250 Ohms D.C. Res.
TC65 50 M/A 30 Henries 400 Ohms D.C. Res.
TC80 150 M/A 30 Henries
TC81 200 M/A 30 Henries

SPEAKER TRANSFORMER REPLACEMENT COILS

F132 Single Low Impedance Triode
F133 Single High Impedance Triode
F134 Push-Pull Low Impedance Triode
F135 Push-Pull High Impedance Triode
F136 Single Low Impedance Pentode
F137 Single High Impedance Pentode
F138 Push-Pull Low Impedance Pentode
F139 Push-Pull High Impedance Pentode

SPEAKER TRANSFORMERS

TS23 Single Low Imp. Triode
TS24 Single High Imp. Triode
TS25 Push-Pull Low Imp. Triode
TS26 Push-Pull High Imp. Triode
TS27 Single Low Imp. Pentode
TS28 Single High Imp. Pentode
TS29 Push-Pull Low Imp. Pentode
TS30 Push-Pull High Imp. Pentode

VIBRATOR TRANSFORMERS

TP81 135 Volts 6 Volts

AUDIO CHOKES

TA4 100 Henries 1000 Ohms D.C. Res. .25 M/A.

VIBRATOR CHOKES

TC58 Low Tension 3 Amps, 50 M/H .5 Ohms D.C. Res.
TC70 High Tension 50 Henries 450 Ohms D.C. Res. 75 M/A

FILAMENT TRANSFORMERS

TP1 2.5 volts 2 amps 7 watt
TP2 4 volts 1 amp 7 watt
TP3 6.3 volts .3 amp 7 watt
TP55 6.3 volts 3 amps 15 watts

AUDIO TRANSFORMERS

TB42 A Class Single Ratio 3 to 1
TB43 A Class Push-Pull Ratio 3 to 1
TB44 B Class Push-Pull Ratio 1¾ to 1

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TP80 6.3 volt, 4 volt and 2.5 volt.

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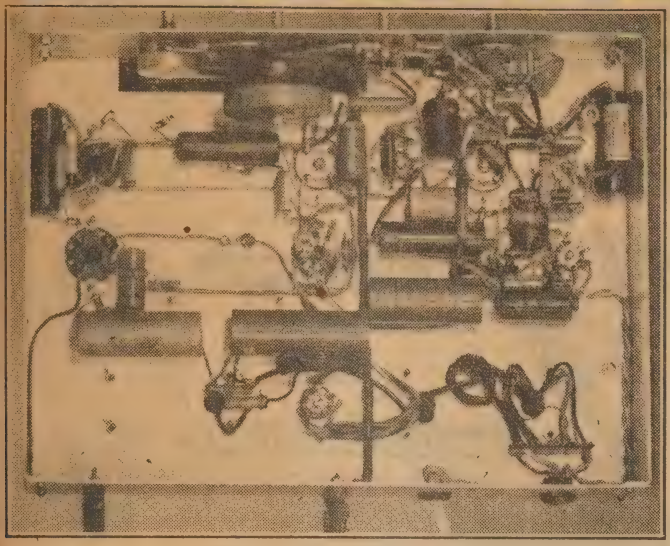
LOOKING UNDER THE CHASSIS



The intentional circuit refinements invoke additional components under the chassis but the layout lends itself to neat wiring. Low capacitance cable is used for the pickup and audio grid wiring rather than conventional shielded hook-up.

At the same time, a bypassed resistor appears in the cathode of the 6BA6, increasing the bias on the valve and reducing its transconductance to a level where the overall gain is about the same as before. Of course, AVC action also has a hand in the matter.

If you want to increase the sensitivity of the set a little and you are prepared to overlook some change in volume when moving from the "wide range" condition to the "normal" condition, you can reduce the value of the cathode resistor in the 6BA6 cathode whilst keeping an eye on the stability of the stage. In the original set, we were able to remove the cathode bias on the 6BA6 with the switch in the "normal" position without any sign of instability.

Moving now to the following stage, the 9-pin 6N8 was chosen to provide second detcetion, AVC and first stage audio amplification because it is the only easily obtained duo-diode-pentode in the miniature series.

GRID LEAK BIAS

The valve manufacturers quote operating conditions whereby the valve can be used in audio amplication with grid leak biasing. Being able to ground the cathode, the usual cathode resistor and associated bypass capacitor can be dispensed with, making matters much easier from a number of angles. Incidentally, the highest stage gain is obtained under these circumstances.

Tracing the wiring of the stage, we see that the diode winding of the No. 2IF transformer feeds one diode anode for detection. In all three positions of the switch section S1b, the 0.05 Megohm resistor at the bottom of the diode winding acts as part of an RF filter network.

In setting the value of this resistor, it was necessary to consider the value of diode load resistance used as the volume control. We wanted to keep this down to about 0.25 Megohm so that a 2 Megohm isolating resistor feeding the tuning indicator grid would prevent undue shunting of the diode load. This being so, the filter resistor was set at .05 Megohm.

DIODE LOAD

The diode load is actually provided by the 0.5 Megohm potentiometer and a parallel resistor of equal value. For radio the two form the required 0.25 Megohm diode load but, for gramo. work, the resistor remains in the diode circuit to provide a DC return path for the diode and for the grid of the tuning indicator.

"The "hot" end of the volume control is taken to one pole of the 2-pole, 2-position, "radio/pickup" switch so that it can be switched either to the diode circuit or to the pick-up terminals.

The other diode anode is coupled to the 6BA6 anode through a 100 pf capacitor to provide by rectification a negative voltage for AVC action. The load resistor for this diode anode is returned to the negative side of a 30 Ohm resistor connected in the power transformer centre-tap where about 2 volts of negative bias is developed. This bias acts as a delay voltage for the AVC diode anode and is applied also to

the grids of the 6AN7 and the 6BA6 via the AVC line.

The pentode portion of the 6N8 is a straightforward audio voltage amplifier operating with grid-leak bias. Note the value of the screen resistor for this condition.

The plate and screen feeds for this stage are decoupled with a .02 Megohm resistor and an 8 mfd electrolytic to remove filter hum from the grid circuit of the 6AQ5.

Section S1c of the selector switch operates between the 6N8 and the 6AQ5 stages. In position 1, you will see that negative feedback with bass boosting is in circuit from plate to plate of these stages whilst in position 2 the bass boost capacitor is shorted out. In position 3, bass boosting is brought in again and severe treble attenuation is provided by the .005 mfd capacitor, which is effectively placed from the plate of the 6N8 to chassis. The degree of feedback is of the order of 9 db.

OUTPUT STAGE

The 6AQ5 is a valve which is readily available and is one which has characteristics identical to the 6V6-GT and, as such, is capable of a full 4.5 watts of power output into an optimum load impedance of 5000 Ohms.

In common with all high Gm power valves, it is a wise precaution to insert a parasitic suppressor resistor in series with the connection to the grid of the valve. Cathode bias is employed with this stage rather than returning the grid resistor to a back-bias network in the power transformer centre-tap. In the latter case, it would be more than likely that a decoupling network would be required to keep filter hum from the grid and in the end would require more components than necessary for cathode biasing.

In the case of the rectifier, the 6X4 is the only choice if the miniature series is to be maintained in the set. It is employed with a standard 285 volt per side 80 mA transformer and at first glance the circuit may appear to be a little different from the usual run. It does differ in one instance for a good reason.

H.T. SUPPLY

Considering the lower internal impedance of this rectifier as compared with the 5Y3-GT type, the lower DC resistance of an 80 mA filter as compared with the usual 60 mA size and the fact that the full bias for the output valve is not being obtained through back-biasing, the output voltage from the filter is on the high side.

To overcome this, the simplest method is to insert a resistor of appropriate value between the rectifier output and the first filter capacitor. The added advantage of this method is that the rectifier is safeguarded against excessive peak currents into the first filter capacitor.

From a constructional viewpoint, the set presents no special problems and, in fact, the layout lends itself to neat and systematic wiring.

A point of note is that the gang condenser — an AWA type — is mounted toward one side of the chassis rather than in the traditional centre position. If you obtain the specially stamped chassis, there should be no doubt about its location.

DIAL MOUNTING

When it comes to fitting the dial, remove the flywheel and make sure that the mounting holes in the plate and in the chassis correspond. Having checked this, carefully remove the screw which normally holds the drum on to the assembly plate, holding the drum at the same time to prevent the cord becoming tangled.

Keeping the two parts together, place the dial plate in position against the front of the chassis and, at the same time, roll the drum slightly to one side and slip it over the condenser spindle. After that, a couple of screws will hold the plate firmly in place.

Slip the flywheel on again and then lock the drum on the gang spindle so that the dial pointer shows equal overlap at both ends of the scale with the gang in the fully open and fully closed positions.

All the power and filter components fall naturally into place near the rectifier and we used a couple of tag strips to provide anchor points for wiring functions that would otherwise have floated in mid-air.

Another tag strip was located near the output valve socket to facilitate wiring of the audio circuits between the last two tubes.

In wiring the selector switch, select the contacts nearest the 6N8 socket for the bass compensating circuit, and the contacts nearest 1FT2 for the variable selectivity. Be sure to keep the AVC bypass and other components to do with the RF end away from the audio wiring.

When aligning the receiver, set it in the "normal" position and follow the ordinary procedure. For those who may not be clear about this, we can supply a pamphlet through the query service.

Having completed the alignment, you will find that the variable selectivity feature will function quite automatically with no change in the dial setting.

The gain of the audio amplifier, by the way, is normal for this type of set, being adequate for all ordinary magnetic pickups, as fitted to record players. If your tastes run to a lightweight, however, it would be necessary to select a high output type, notably a crystal. The selector switch will give the choice of normal treble with or without bass boost and a position of bass boost, treble-cut for those pickups requiring this drastic treatment.

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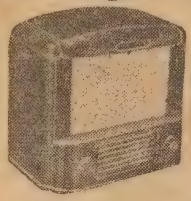

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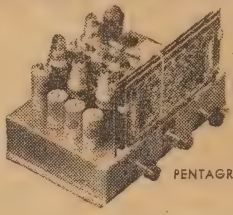
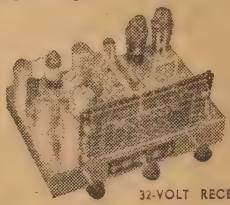
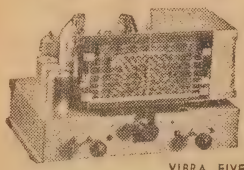


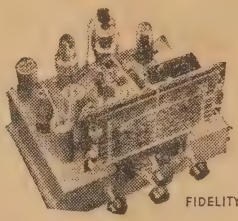
PENTAGRID FIVE



32-VOLT RECEIVER



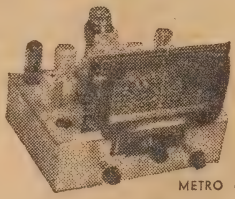
VIBRA FIVE



FIDELITY 5

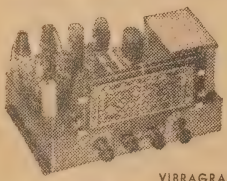
KARSET

INTERCOMM

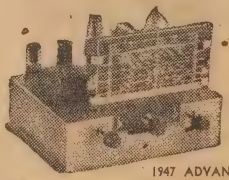


METRO 4

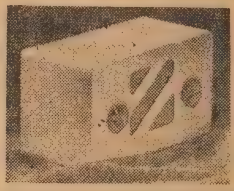
1946 STANDARD



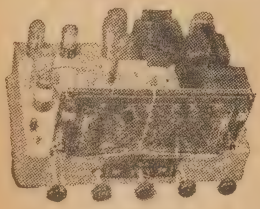
VIBRAGRAM 7



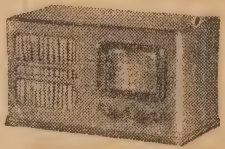
1947 ADVANCE



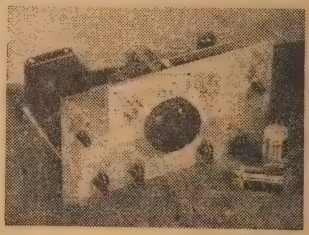
SLUMBER SET



1950 RADIOGRAM



FIRESIDE 5



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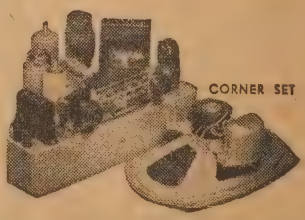

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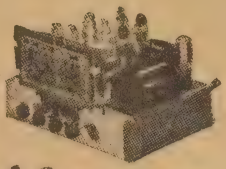
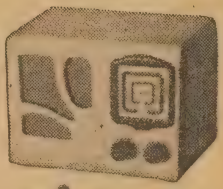
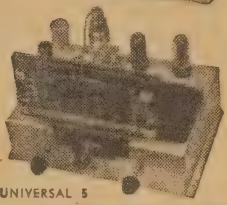


1947 SENIOR OR MAJESTIC RADIOGRAM



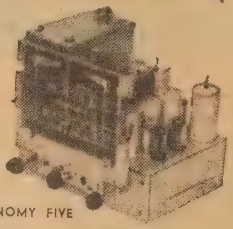
LITTLE GENERAL

SUPER 8 D/W



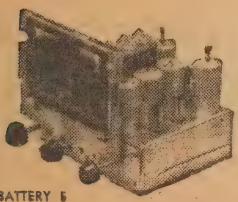
UNIVERSAL 5

SPRINGTIME PORTABLE



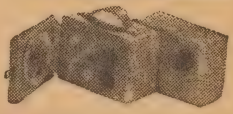
ECONOMY FIVE

CARRY SET



ALL BATTERY 5

SENIOR PORTABLE



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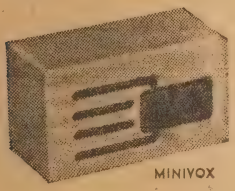
6-240

HANDIE TALKIE 4 & 5 VALVE

TABLEGRAM



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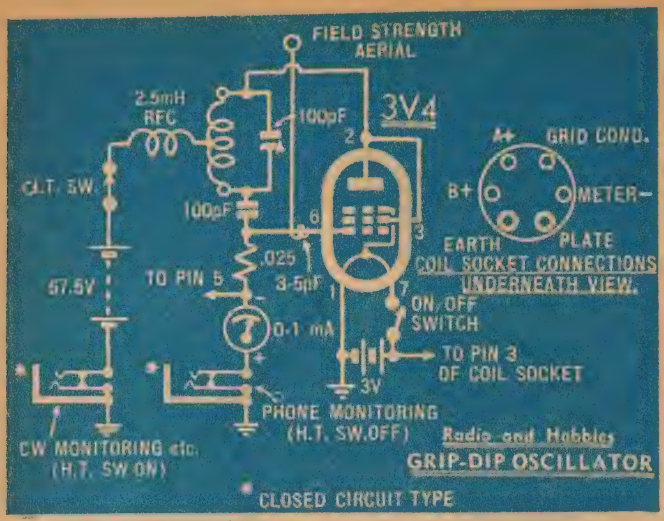


The circuit is the same as already published. As explained in the text, minor variations can be made to accomodate parts on hand.

YOUR GRID-DIP OSCILLATOR

You can increase the versatility of your grid-dip oscillator by winding extra coils to cover the range from 3.0 to.45Mc which includes the broadcast band and also takes in the usual intermediate frequencies. This article describes a version of the Radio and Hobbies grid-dip oscillator built by one of our staff members for his own use.

by Maurice Findlay

AS you may remember, the original instrument described by Ray Howe in the April, 1950 issue covered from approx. 3 to 80 Mc with four coils. I was duly impressed with the versatility of the instrument and the ease with which coils for receivers, transmitters &c. can be adjusted and decided to build a similar instrument for my own use. With an extensive building campaign about to start, it will come in for a great deal of use in the near future.

The original coverage is quite adequate for general use around an amateur station but I thought I would like to extend the coverage to the broadcast band and even down to the intermediate frequency range.

SPECIAL JOBS

However, it is sometimes necessary to determine the IF of an odd disposals receiver or to make a loop aerial for a personal portable. In practice the lower ranges are often well worth while. The instrument even makes quite a handy signal generator, particularly on the lower frequencies, where the accuracy of the calibrations is quite good. If you install a meter in the plate circuit of one of the AVC controlled tubes, the fact that it injects a fairly strong signal into the receiver is not so important.

Ray explained how the instrument could be used as a field strength meter, absorption frequency meter, standing wave indicator, neutralisation indicator and CW and phone monitor, in addition to its normal function as a grid-dip oscillator. All this appeared in the April issue and there is no reason to cover the same ground again.

The original instrument uses the 3V4 battery output valve, triode-connected and wired as an ultraudion oscillator. This is actually a special version of the well known Coupitts circuit. The difference is that the capacity division is made by the internal capacities of the valve rather than by the tuning condenser. Naturally, the capacitance figures between the elements of the valve are quite low and there is a lower frequency limit below which this circuit will not operate satisfactorily.

However, it is possible to make the circuit into a Hartley oscillator simply by bypassing the centre tap of the coil to earth. The Hartley circuit will operate to as low a frequency as necessary. If you have already built the instrument, there is no need to make any alterations to cover the extra ranges as the bypass capacitor can be installed separately in each coil.

One of the coil socket pins is already connected to earth, so that the bypass capacitor can be slipped inside the coil former and wired between the coil centre tap and earth. There is plenty of room, even for the larger type acpacitor. All that is needed is a steady hand to avoid melting the plastic former.

The capacitors are essential if the instrument is to oscillate reliably on the ranges below 3 Mc. With the coils covering between 34 and 3.0 Mc it is possible to obtain a slight improvement in the strength of oscillation by installing the condensers but I did not consider it necessary. You can check this point for yourself.

In the case of the 80 to 33 Mc coil, it is not desirable to install the condenser, since the instrument oscillates more reliably with the ultraudion circuit.

The lowest frequency coil (.7 to .45 Mc) has a 25 pf padder condenser installed, since it is not possible to wind quite enough turns of 32-gauge wire on a standard plastic former to reach 455 Kc with a 100 pf tuning condenser. By the way, there is no need to count the exact number of turns on this coil since it is a very laborious job and it is sufficiently accurate to measure the length of the winding.

COUPLING IS CRITICAL

At the low frequencies, the degree of coupling between the instrument and the external circuit is a little critical to adjust. If the coupling is too great, the external

COIL DATA

COIL A 80 to 33Mc
¾ turn, 20 B & S.
COIL B 34 to 14.5Mc
4 ¾ turns, 20 B & S, spaced 3/8"
COIL C 15 to 6.5Mc
11 turns, 20 B & S.
COIL D 6.5 to 3.0Mc
33 turns, 20 B & S.
COIL E 3.0 to 1.4Mc
54 turns, 32 B & S.
COIL F 1.4 to .7Mc
1 ¼" length 32 B & S.
COIL G .7 to .45Mc
2 ¼" length 32 B & S. 25 pf condenser in parallel with winding.
All coils wound at top of former. All coils centre tapped. Centre tap of coils D, E, F and G bypassed to pin 1 with .001 mfd capacitor.

circuit will have a tendency to pull the instrument out of oscillation and, if too little, the dip will not be definite. The idea is to start with fairly close coupling until the approximate frequency is determined, and gradually move away until it is just possible to obtain a definite dip.

Incidentally, if you have a particular interest in the 14 Mc amateur band, there may be some point in increasing the inductance of coil B so that it will tune as low as 14 Mc. The bandspread will be greater than at the high frequency end of the next band. About five turns spaced ¼in should make the range from about 32 to 13.9 Mc.

To accommodate parts on hand, I made some slight alterations to the original circuit and there are also some minor alterations to the physical layout. There is no difference in the performance of the two instruments, when used side by side on the bench, and the changes are mentioned simply as a matter of interest.

Rather than spend several pounds of "hard-earned" on a new 0-1 mA meter, I decided to use a small 0-2 mA meter which happened to be on hand. Actually it came from a dismantled Japanese transceiver. To increase the grid current and give better deflections, I reduced the value of the grid leak from 25,000 to 15,000 ohms. The valve, incidentally, is a 3S4 since it also happened to be available. If you use a 3S4 be sure to remember that the socket connections differ from those of the 3V4.

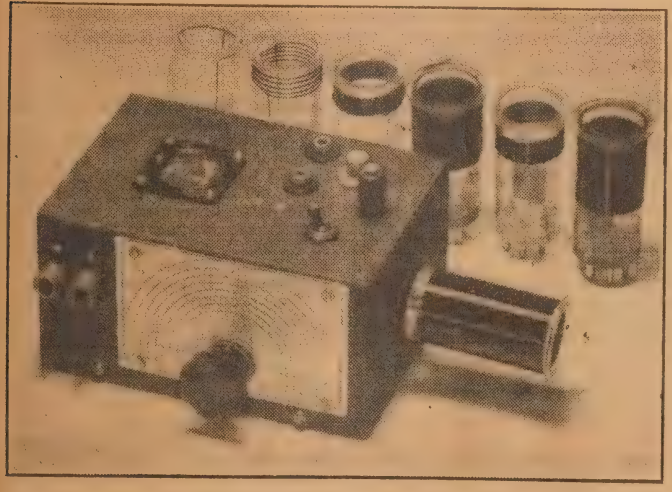
The smaller meter makes it possible to use one of the standard 1.5V torch cells for the filament supply and the expected life will be greater than that of the two miniature cells used in the original version. The two filament sections are wired in parallel, of course, to operate from 1.5V.

SPRING LOADED SWITCH

With a toggle switch in the filament circuit there is some danger of the instrument being left switched on and, as I happened to have a spring-loaded switch on hand, it was used. A pair of pin jacks are brought out to the front panel to bridge the switch when the instrument is required to be left on for a long period such as when monitoring a transmitter. However, the spring-loaded switch is a wonderful battery saver when the instrument is in intermittennt use on the bench.

The layout can be seen from the photograph. The two jacks are mounted together on the side of the instrument and the filament switch on the front near the top where it is easy to operate it with the thumb when holding the case in the left

(Continued on Page 79)



Grid-dip oscillator "Mark II" complete in a crackle-finished case and seven coils covering the range from 80 Mc to 450 Kc.

Let's Buy An Argument

Having unloaded a few grouches over the past six months, I had begun to settle down into a state of smug complacency, making comment as necessary but never becoming uncouth or disagreeable. But how can one possibly maintain such equanimity when confronted by a variety of provocative (and inaccurate) statements?

by W. N. Williams

FOR example, by way of small talk, I asked one of the technical fraternity recently about an FM radio-telephone which had been installed by a local government body. In other words, a friendly "How's it going?"

His answer was something like this:

"Extra good. FM sure makes AM look silly."

If the statement were an isolated expression of opinion, one wouldn't worry. But it isn't. I've heard it many times and always based on the same erroneous observations.

No, I don't own shares in an AM factory and I don't own any patents that would affect the matter. It's just that I don't like to see an old friend ill-used. Let me tell you the real story.

When radio-telephone facilities were first fitted to cars and trucks, they invariably used AM equipment and most of it operated in the 2-3 Mc region. As often as not, the receivers were ordinary communication types, screwed down to a mounting tray and left tuned to the appropriate frequency.

Is it any wonder they were jolted out of tune? Any wonder they were noisy, in the noisiest part of the whole spectrum? What's more, they lacked refinements like crash limiting and the all-important "squelch," to silent the receiver between calls.

It was only after the war, equipped with miniaturised components and a wealth of new experience, that designers really came to grips with the radio-telephone business.

They built receivers and transmitters especially for the job—and therefore they were smaller and more serviceable than the old "adapted" gear.

They installed crystal control for both units, thereby eliminating frequency drift.

They went to the newly allocated VHF channels which, at one stroke, eliminated all atmospheric interference and a good deal of the man-made variety into the bargain.

WHAT ABOUT FM?

It became possible also to use truly resonant aerials on the cars, which boosted tremendously the propogation efficiency and the signal strength within the required 10-15 miles radius. Ask an amateur about local signals on VHF and you'll see what I mean.

"But, mister, you haven't mentioned FM."

"Be patient, be patient. I'm putting the important things first."

I know that sounds like heresy but it isn't anything of the kind.

FM was widely adopted for radio-telephone at the same time and, thanks to inspired salesmanship, mainly from overseas, it acquired a fantastic reputation for powerful noise-free reception.

I am well aware that FM as a principle offers some protection against noise, but as matters turned out, it got the credit for all the other improvements as well. The strong signals, the freedom from frequency drift and a good deal of the noise elimination is due to modern techniques and VHF, not to FM at all.

What a laugh!

Build an AM outfit to similar specifications, and the same stability and signal strength will be evident. Add muting and the set is silenced between calls. Then add automatic noise limiting, as featured in many Radio and Hobbies receivers, and the crackles and ignition pops disappear like magic.

What's more, the finished receiver is likely to have one-third fewer tubes and one-half the circuit complication of its FM counterpart.

There are good and bad points about both systems but, taken by and large, they break pretty well even. What one loses on the roundabout it makes up on the swings.

Have your own preference by all means — I must concede you the right—but for heaven's sake don't be guilty of reciting, parrot fashion, the phrase "FM is much better than AM." There's a good hour's debate to be had any time on the question.

Getting back to audio topics, I must also take a crack at what is a very common but completely fallacious idea about scratch filters, as applied to gramophone pickups.

Goodness knows how many times we are asked for details of "a simple scratch filter." Then, by way of further explanation, we get: "Something to tune out the scratch on the record, you know."

It's about time this idea of tuning out the record scratch was scotched once and for all, and the real function of a scratch filter understood.

Scratch has always been a problem and, in the days before lightweights, it was most prominent in the treble register around the 3¼ to 4 Kc. mark.

SCRATCH FILTER

Naturally, the more technical souls began to cast around for a remedy and, very soon, they found it. A neat little absorption circuit connected to the pickup worked wonders and, in many cases, didn't seem to affect the treble. How come?

Now I don't say that everyone fell into the same trap but some did start to make abstruse calculations involving groove speed and the size of "filler" particles and such like used in the record material.

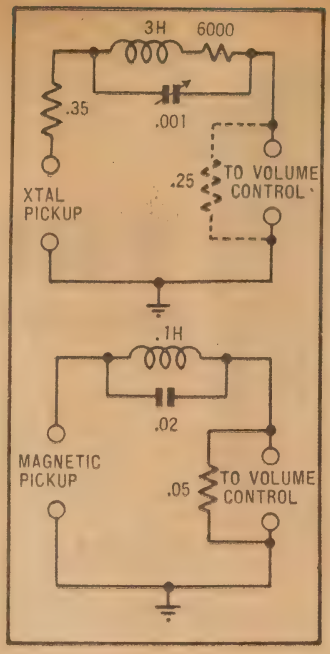
So was born the theory that the record noise "peaked" in a certain region and the problem was simply one of tuning out the peak.

I hope I'm not doing an injustice to someone technically my superior but it seems to me that any such peak would have to be mighty broad. In any appropriate formula, the lineal groove speed would be a unit quantity and it obviously varies by more than 3 to 1 over an ordinary 12in disc. Add another variable involving particle size and the elusive peak could be anywhere from here to there.

But even if the theory were well founded, it wouldn't help much. Let's say that an absorption filter could cut the scratch frequencies over a certain limited band by 10 db. The immediate effect would be to cut the treble in the same region by the same amount and the result would sound rather horrible.

No, that's not the story so, for heaven's sake, let's give it away once and for all.

In actual fact, the noise produced by a disc and turntable is a random quantity having components which, under varying circumstances, can extend from one end to the other of the audible range. Fundamentally, therefore, the correct approach is to seek quieter surfaces and noise-free turntables—and this is being done.



The simple scratch filter circuits for a crystal pickup (top) and a magnetic pickup (boitom).

Meanwhile we may as well appreciate the true effect of record scratch.

Most pickups exhibit a natural resonance in the treble register, the stylus assembly tending to vibrate more freely at a patricular spot in the range.

When activated by random irregularities in the groove wall, the stylus tends to generate damped wave trains and to deliver an output which is an inter-modulated product of the natural resonance and the random noise impulses. The net effect is an audible scratch having a distinctive pitch.

EFFECT ON NOISE

Now, by installing an absorption filter in the pickup circuit, tuned to the right frequency and having the right amount of absorption, it is possible to reduce the intensity of this scratch. Furthermore, there need be no loss in the treble response, because the filter will simply reduce to the correct level those frequencies which have been artificially boosted by the pickup resonance.

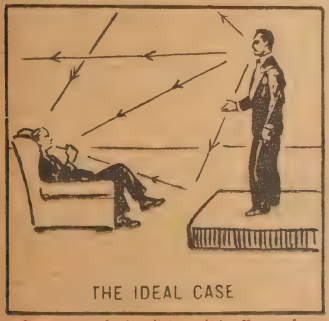
But see the point—scratch filters are not intended to tune out the scratch on a record, because that can't be done. They serve fundamentally to offset resonance in the pickup and they are only necessary if the pickup exhibits this failing.

With a pickup having an essentially level response, there will be no noise peak and nothing for a filter to tune out.

Therefore, before one can really answer a question about a scratch filter it is necessary to know the following:

INFORMATION PLEASE

1. Has the pickup an apparent resonance peak. That will determine whether or not a filter is necessary
2. Is the pickup a magnetic or crystal type? This governs the type of filter.
3. Where is the pickup resonance? This determines the frequency to which the filter must be tuned.
4. How large is the response peak in terms of db? On this depends the "Q" of the filter.
5. What is the impedance of the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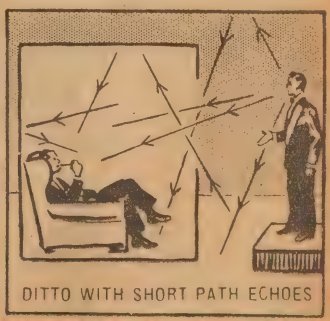
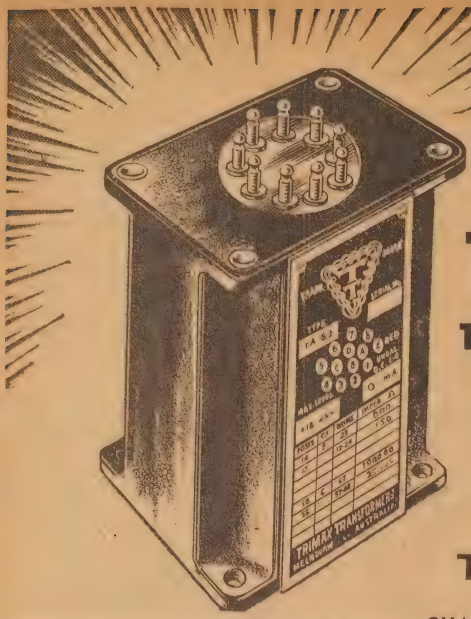

DITTO WITH SHORT PATH ECHOES

One way of visualising the effect of an amplifier. Imagine your listening room to be extended into the auditorium and your speaker is replaced by an open window facing the performer.



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pickup? This will determine the required ratio of L/C.

This might sound like a technical build-up but those indeed are the factors which have to be taken into consideration. The problem can be simplified by making some general assumptions.

Thus, if one likes to assume that all old magnetic pickups have a resonance about 4 kc equal to about 10 db and that they work into a 50,000 ohm load, it is possible to suggest such and such a coil and condenser that has a chance of cutting down the peak and the scratch.

NEW PICKUP ?

That is one approach. A better one is to buy a more modern pickup, either with level response, or with a resonance so high that it is above the good-response region of the speaker.

And, of course, the speaker too, plays its part in suppressing or accentuating the scratch. Let the speaker show a bad peak in the upper register and you'll hear the scratch to good advantage, pickup notwithstanding.

Let the speaker peak coincide with the pickup peak and you'll really sit up.

Strangely enough, it works out in practice! A truly level system, operating to 10 Kc, will generally sound smoother and quieter than one limited to half that figure but exhibiting a bad peak.

I think the point has been amply made.

Of course, talk is cheap and not everyone can afford to throw pick-ups into the garbage can—then wander off nonchalantly to buy a couple more.

If you have one of the older pick-ups and want to try out this scratch filter business, then figure 1 will give you some idea where to start.

TYPICAL CIRCUITS

The one for the crystal filter, for which I claim no credit, is a bit tough because it requires a nasty value of inductance. The only easy way I can think of to get the required 3 henries would be to use the primary of a small speaker transformer and keep on removing laminations until the tuning condenser can be heard tuning through the scratch frequency. For the condenser, you could possibly use a small 2-gang with the sections wired in parellel. The whole thing would need to be shut up in a metal box to avoid hum troubles.

The filter for the magnetic is easier, which is just as well, because it will normally be the one most urgently required. Make up a bobbin from a ½in length of broom handle and a pair of 2in diameter cheeks from plywood, masonite or bakelite. Then wind on 2000 turns of 31 B & S enamel wire. Play around with the value of the condenser until the best results are obtained.

So much for that.

For those who like arguing about the aesthetics of sound reproduction, here is a contribution from P. G. A. H. Voigt, of loudspeaker fame. Writing in "Audio Engineering" he points out the fallibility of comparing even the best single channel reproduction with what is heard in the concert hall. He then suggests a way in which a better mental picture can be built up for purpose of comparison.

In a concert hall, the listener hears the sound both directly and by devious reflection paths. He also uses both ears and is conscious of direction and breadth—something that is completely impossible with any single channel system.

However, one might visualise the whole listening room as being transported by magic carpet into the concert hall and the speaker replaced by an open window which effectively allows the sound to enter the room by one path only.

Through this opening the listener will now hear the direct sound, plus some of the echoes which have followed devious paths around the auditorium.

Finally, there will be present the direct echoes which belong only to the listening room and which will necessarily have a much briefer time delay than those belonging to the larger auditorium.

CLOSE CONDITIONS

When the speaker or instrumentalist steps close to the microphone, the effect is precisely as if he stepped right up to the open window. There would be no important auditorium echoes, the only ones remaining being those peculiar to the listening room.

What then do you expect to hear when you dim the lights or close your eyes and concentrate on your favorite recording? Are you trying to imagine yourself in the concert hall and expecting the amplifier to complete the illusion. Forget it for it never can be realised fully with a single channel system!

The real test, Voigt suggests, is to imagine that the whole room has been transported to the auditorium and that the speaker has been replaced by a window which opens on to the stage. If the sound you hear is as true and uncolored as through an open window, then your amplifier is approaching the ultimate.

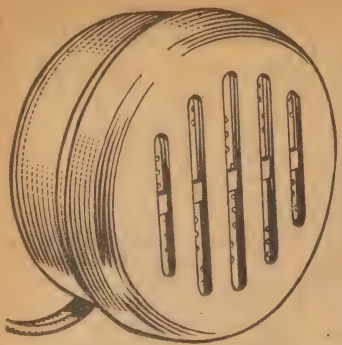
Well there you have it. I hope that, in summarising a more lengthy article, I have not put words which do not belong into the mouth of Mr. Voigt. While not agreeing with all his ideas on sound reproduction, I think this one is basically true.

What do you think?

A few letters have been held over, both from lack of space and out of consideration for those not vitally interested in the mechanics of disc recording.

However, the discussion which was rounded off last month has set quite a few people thinking and the last has not been heard of the subject.

Come to think of it, I like this business of arguing. What a horrible person to live with!



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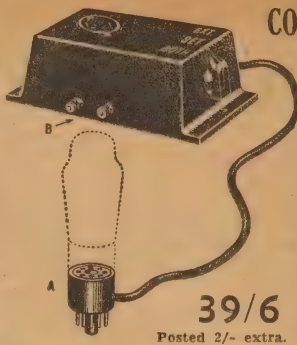

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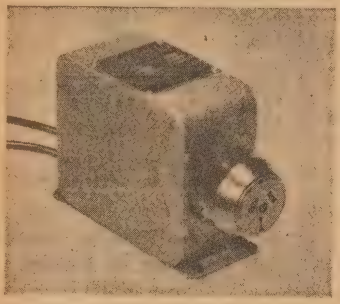

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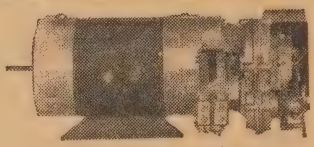

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PART 22—SAWTOOTH GENERATORS (Cont.)

Continuing the discussion of sawtooth generators, this article suggests improvements on the normal gas triode circuit and also lists other simple circuit arrangements. Though not necessarily employed in advanced receivers, some of these less complicated systems may be of ultimate value to home constructors of small television sets.

THE linearity of a simple gas triode oscillator, as described in the last article, can be improved greatly by the addition of a linearising pentode in series with the charging circuit. It can be connected in various ways, but a typical and convenient arrangement is suggested in figure 1.

Here the pentode, which can be an ordinary RF amplifier type, is connected in series with the cathode return of the gas triode. Either the negative of the positive side of the supply can be earthed, as required, but due care is necessary in either case to avoid applying an excessive peak voltage across the heater/cathode insulation of the individual valves.

OPERATION OF CIRCUIT

During the initial cycle of operation, V1 draws plate current and, by so doing, builds up a voltage across the timing capacitor "C" and therefore across the gas tube V1. In other words, the lower plate of "C" in the drawing is made gradually negative with respect to the upper plate.

When the potential across the condenser and across V2 reaches a certain critical value, the tube ionises and abruptly discharges the condenser. This action carries the plate of V2 once again to a high positive potential and the charging action commences once again, the cycle of events being repeated indefinitely.

The rate of charge into the condenser C is actually dependent on the plate current of V2, since V2 provides the negative return path for the whole gas triode circuit.

CONSTANT CURRENT

It is characteristic of a pentode that the plate current is largely independent of plate voltage, being governed more by the standing screen and bias potentials.

In this circuit, the screen potential is held steady by a divider network across the high tension supply. The bias is adjusted in the cathode circuit, the two quantities together setting the plate current of the tube.

As already stated, this remains substantially constant at the pre-set figure and maintains a fairly constant charging current into condenser C. As a result, the build-up of voltage across C, representing the forward timing trace, is made more linear.

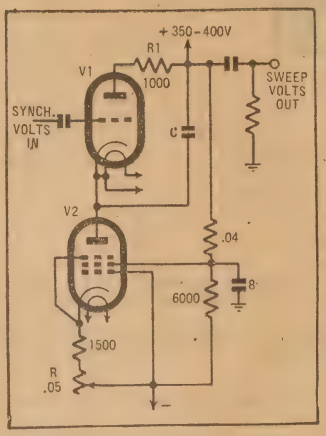


Figure 1. Typical interconnection of a pentode and gas triode to give a more linear sweep. The same principle can be applied to other oscillators.

The rate of discharge is still limited, however, by the peak current capacity of the gas triode and therefore by the limiting resistor R1. A further point is that it takes an appreciable and a rather indefinite period for the ionisation to disperse, which lends a somewhat erratic quantity to the final result.

As a result, there has been a definite trend away from gaseous valves in high definition receivers to the so-called "hard-valve" time bases—those employing conventional vacuum tubes.

Such valves lack the inherent ionisation characteristics of the gaseous types and therefore the ability to function as a simple relaxation oscillator. Special measures are normally necessary to bring about an abrupt change in valve impedance sufficient to discharge the associated timing circuit.

Possibly the simplest form of hard valve time base is illustrated in figure 2.

Here the valve is supplied with appropriate plate and screen potentials, but with a standing bias sufficient to maintain it beyond plate current cut-off.

In this condition, condenser C is charged through R, the rate and degree of charge depending naturally on the circuit constants.

SYNCH. PULSES

When the Synch. pulses are applied to the grid, each positive-going pulse causes a burst of plate current to flow, or, put another way, it momentarily lowers the impedance of the valve. This discharges C at each pulse, the charge tending to build up again during the intervals.

The circuit has been used in commercial receivers, but it suffers from certain important limitations: In the first place, the synch pulses must be of large and consistent amplitude, since they control the whole discharge period of the tube rather than merely acting as a trigger. The complication of supplying such pulses may well be greater than that of installing a more elaborate timing circuit.

A further difficulty with the circuit is that the oscillatory effect depends entirely on the presence of an input signal. If the receiver is

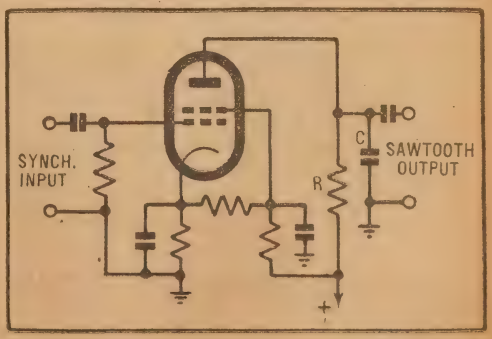
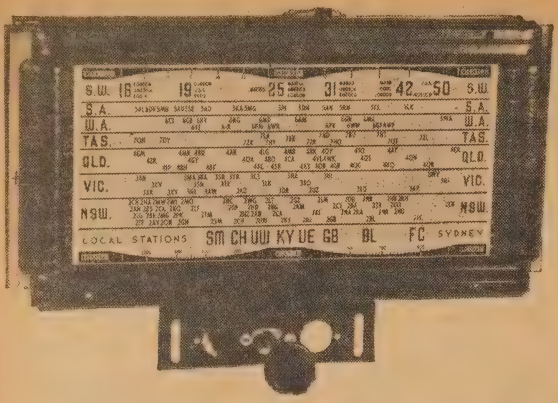


Figure 2 An elementary sawtooth generator actuated by the synch. pulses. It ceases to operate in the absence of signal and may cause damage to the screen of the picture tube with a set designed for negative modulation.



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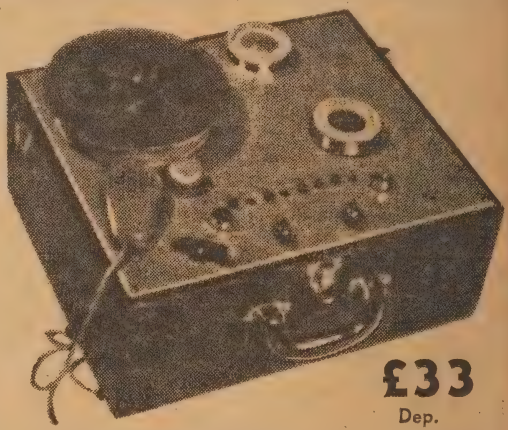

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not switched off immediately the transmission ceases, the spot is not deflected and, with negative modulation, the high intensity beam would soon damage the tube.

In order to overcome these difficulties and to make a "hard" valve operate as a self-oscillator, it is necessary to introduce a feedback path around it, and this can be done in a number of ways. The general approach is to make the time base valve oscillate, and then modify its actual output by means of a superimposed R/C timing circuit. This may sound rather involved at first reading, but the circuitry used will be familiar enough.

ANOTHER CIRCUIT

Figure 3 shows a type of feedback circuit, which has been used to some extent in overseas receivers.

It shows a triode valve, and the respective windings of a transformer connected to the plate and grid circuits. The transformer design depends largely on the proposed operating frequency, but one essential feature is extremely tight coupling between the two windings. The plate is fed through a high value of resistor and the feed point bypassed to earth by a selected condenser C.

To explain the operation of the circuit, first assume that there is a moderate voltatge effective on the valve plate at a particular instant.

The valve draws plate current through the primary winding of the transformer and, in so doing, induces a voltage across the grid winding. The two windings are phased in such a way that the grid is carried in a positive direction, tending to increase the plate current abruptly.

The rate of increase cannot be sustained, however, because R has a deliberately high value and the charge across C is soon depleted. Therefore, plate current saturation becomes evident and the rising grid potential cannot be maintained.

FEEDBACK EFFECT

The field around the windings begins to collapse, carrying the grid negative and lowering the plate current. The action is accelerated by the transformer feedback, so that the grid is made highly negative with respect to the mean cathode potential.

While the valve is in this state of plate current cut-off, the condenser C is being charged again through R. Ultimately, the potential reaches a point where plate current can flow and the original cycle is repeated.

By suitably apportioning circuit values, a reasonable sawtooth output can be obtained across C.

A popular variation of the scheme is found in the socalled "blocking oscillator," illustrated in figure 4. The sawtooth output is rendered less dependent on the feedback transformer, and, in fact, blocking oscillators can be made to function with the feedback circuit resonant at a high radio frequency. While such matters are quite important in the ultimate design, the aim at this juncture is to examine operating principles rather than the finer details of each circuit.

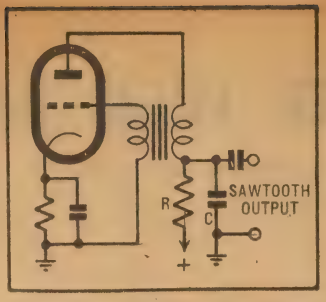

Figure 3. Another elementary sawtooth generator using a feedback transformer.

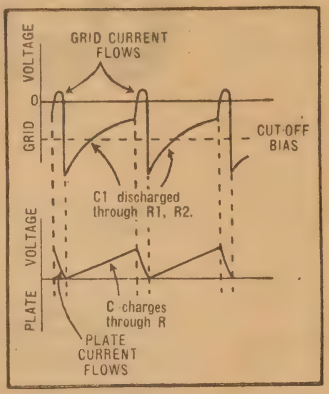

Figure 5. Illustrating the cycle of operations in the grid and plate circuits of a blocking oscillator.

An immediate point of difference between figures 3 and 4 is the inclusion of a capacitor and resistor in the grid circuit. The oscillator, in this case, involves the cathode-grid-screen structure of a pentode of tetrode, leaving the plate circuit available for independent output coupling.

To trace the cycle of operation, assume that the valve has zero initial bias, a normal screen voltage and a moderate plate voltage, this latter being equal, of course, to the charge across condenser C.

The circuit cannot remain in this condition because of the feed-back path and oscillation must inevitably occur.

The moment oscillation begins the grid draws current and charges C1 in the polarity which forces the standing grid potential negative with respect to earth. In a blocking oscillator C1 is normally kept high in value, but it can charge rapidly and to a high potential while grid current is flowing. A figure of -100 volts is not uncommon.

Given favorable circumstances, the grid will generate such a high negative potential that it interrupts oscillation and, therefore, the grid ceases to conduct. This leaves a large potential across C1 and a path through R1, R2 by which the charge can leak away, and the valve cannot commence a new cycle of oscillations until it does so.

By making the time constant of the combination C1, R1, R2 sufficiently long the discharge period may have many times the duration of the charge period. Furthermore, the discharge period can be controlled conveniently by providing a variable component R2.

FAMILIAR PRINCIPLE

Once the charge across C1 diminishes to less than the standing cut-off bias for the valve, plate current again flows and a new cycle of oscillations will commence. This is the operating basis of any squegging oscillator and also of the familiar super-regenerative detector.

As indicated in figure 5, the mean grid potential produces an approximate sawtooth pattern, but the oscillation period builds up a sharp positive burst, while the discharge period exhibits the characteristically non-linear pattern of an R/C circuit. To overcome these difficulties good use is made of the plate circuit.

It will be obvious that the brief period of oscillation will be characterised by a substantial plate current, while the discharge period will produce no plate current, since the grid is biased more negatively than cut-off. Therefore the plate current must flow in brief bursts, having a period equal to the "blocking" frequency in the grid circuit.

To turn these bursts to good account the plate is fed through a large resistor R, which commonly has a value as high as 0.5 megohm. It is bypassed to earth with a capacitor C.

(Continued on Page 93)

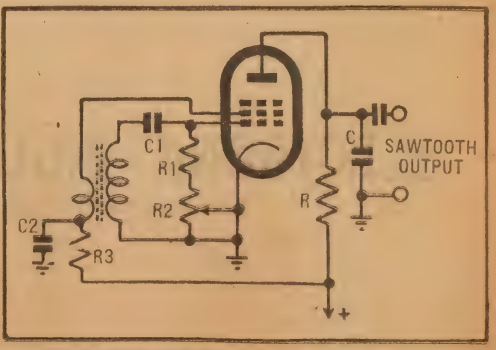

Figure 4. The popular blocking oscillator, as described in the text. The blocking frequency is determined mainly by the constants in the grid circuit but the sawtooth output is derived from a second R/C circuit connected to the plate.

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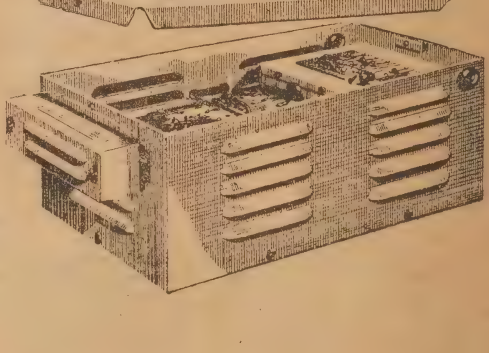

The Valradio invertor can be supplied with specially calibrated vibrators for any frequency within the range of 40 to 75 c/s. These invertors are suitable for most purposes where an AC supply is essential. The frequency stability is exceptionally good and may be used for driving tape recorders, synchronous gramophone motors and other devices requiring accurate frequency AC supply.

The standard DC/AC invertor is not suitable for operating gas discharge devices such as flourescent and neon tubing, special models, however, can be supplied for this purpose. These heavy duty DC/AC non-rotary invertors are available in sizes to meet the widest possible range of DC input and AC output.

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A READER BUILT IT!

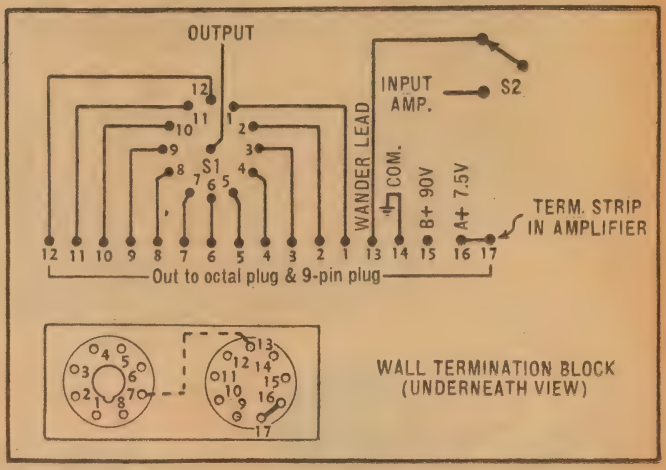
Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

INTERESTING IDEA FOR R & H INTERCOMM

With many of our designs as a basis, quite a number of readers come forward from time to time with interesting variations. This particular one relating to the Improved Intercomm Amplifier of the May, 1949 issue of Radio and Hobbies is a good one worthy of inclusion in such units where they make up a large installation.

THE diagram, shown at the right, of the relative portion of the circuit illustrates the idea. Whereas, in the original circuit, the "wander lead" was connected to the appropriate line within the amplifier, the suggestion made by Mr. H. H. Cane, of Borban Road, Holland Park, SE3, Qld. is to connect the "wander lead" to a point on the terminal strip in each amplifier of the intercomm system, taking it out with the other leads to the wall termination block.

At the wall termination block, the "wander lead" pin is bridged across to the appropriate pin representing the line or station number of that particular location. In the diagram, line 7 is used for the illustration.

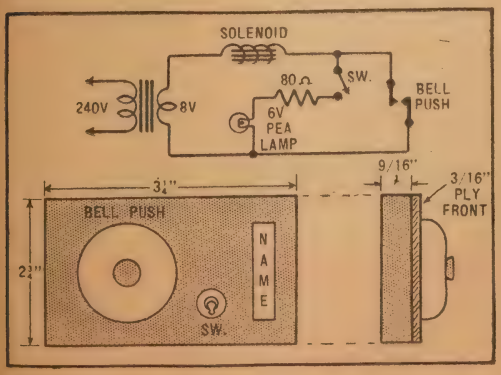


The result is that any intercomm amplifier unit can be plugged into any wall termination block in the system, the "wander lead" being automatically "switched" over to the appropriate line in the process.

AN ILLUMINATED DOOR BELL-PUSH

HERE is a novel idea submitted by Mr. B. G. Bingham, of Laura Street, Launceston, Tasmania. Briefly, it consists of a frame made to form a hollow box with a plywood front. A recessed cut-out is made in the plywood to take a piece of frosted glass upon which is printed the name of the occupant.

The name on the glass is illuminated with a 6-volt torch globe mounted behind the plywood front. It will, of course, be necessary to print the name in reverse. It can be done easily with the aid of a small mirror or by printing on tracing paper, reversing it and then gumming it to the glass.

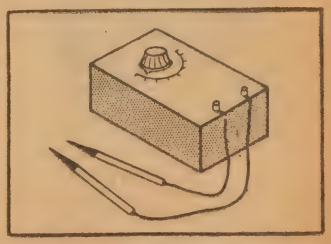


The electrical circuit is self-explanatory. The transformer is the usual bell-ringing type. The switch in the light circuit is optional while the value of the series resistor can be selected to suit the degree of illumination desired.

FOR SERVICE WORK

OUR contributor, Mr. L. W. Willcocks, of Wyangala Road, Woodstock, NSW, sends along this suggestion in the hope that it will be of interest to some of our readers. The idea is to mount a 1 megohm potentiometer and a pair of terminals in a small box. A pointer knob and scale is fitted to the potentiometer shaft.

With the aid of a multimeter, the scale can be calibrated in ohms. With a pair of test prods attached



to the terminals, a handy source of known values of resistance is available for substitution where a resistance component is suspected of being faulty or where a value of resistance is being selected by trial and error.

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Thus, in IRC Controls you have DOUBLE assurance of smooth action that is quiet—and STAYS quiet. There's NO SLIDE, NO FRICTION, NO NOISE. Size—they are only 1⅛" diameter. Brass spindles. No die casting is used in manufacture, therefore there is no distortion or creeping with the passing of time. Insulated shaft. ½-watt rating. D.P.S.T. or S.P.S.T. switches for mains of low voltage operation.

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TRADE REVIEWS AND RELEASES

FERGUSON POLE TRANSFORMERS

Latest addition to the Ferguson range is a line of pole distribution transformers intended for rural electrification schemes. Both single and three-phase units are available.

THE single phase transformers have a kva rating of 5, 10 and 15 and are available with primary tappings for 11,000; 10,750; 10,500; 10,250; and 10,000 volts. The L.V. side consists of 480-240 volts and the full-rated power loading can be imposed on the 240 volt windings.

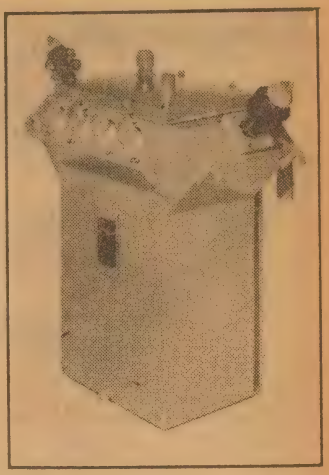
Two high voltage terminals are fitted in pockets on each side of the transformer, while the low voltage bushings are fitted in a pocket at the front. Hanger straps are provided for pole cross-arm mounting.

All tests are carried out in accordance with British Standard Specifications.

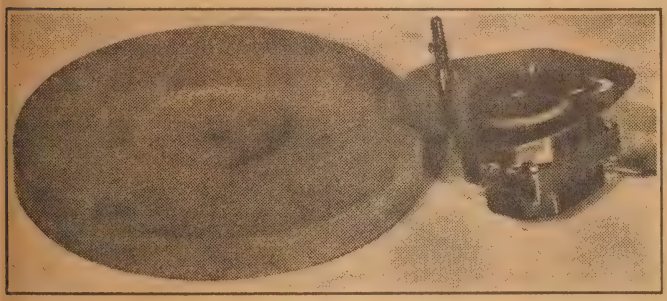
Fergusons also manufacture a range of 3 phase 11 Kv pole distribution transformers in the following sizes:—10, 15 and 25 Kva. These also are provided with hanger straps for pole cross-arm mounting. Delivery on these items is within 6 weeks to 2 months.

The tappings on the high voltage sides of the 3-phase transformers are the same as on the single phase. The low voltage windings are suitable for 415 or 240 volt usage on the 3 phase transformers.

Further information may be obtained from Ferguson Transformers Pty. Ltd., Ferguson Lane, Chatswood, NSW.



A TWO-SPEED GRAMOPHONE MOTOR



Anticipating the introduction of microgroove recording, Goldring Industries have released a relatively inexpensive two-speed motor on the Australian market. It will play either 78 or 33 rpm records as required.

THE drive motor, as will be evident from the photograph, is suspended by rubber mounts from the metal base plate, the spindle driving a rubber tyred wheel through a stepped brass bush. To change the speed it is necessary to loosen a small grubscrew locking the bush and turn it over end for end.

The rubber-tyred transfer wheel drives the underside of a 10 inch turntable, which rides on a separately mounted spindle.

A useful feature of the design is that the drive wheel is held only lightly against the drive spindle when the motor is stationary, tending to wedge more firmly while in actual operation. There is no danger, therefore of the rubber tyre developing bumps or flats during periods of non-use.

A sample motor, submitted for test, had a large reserve of torque on both speeds. Physical noise was about average for the general class of motor, being sufficiently low for ordinary radiogram use. Speed regulation appears to be good, but the method of speed adjustment would not lend itself to rapid change for playing a jumbled assortment of records. This may not be a serious objection in practice.

The motor is distributed in Australia by Goldring Engineering (A'sia), Pty. Ltd., of 57 H. E. Area, St. Marys, NSW. Supplies are coming forward regularly for release through normal trade channels. The retail price is approximately £5, the exact figure being subject to adjustment with individual shipments.

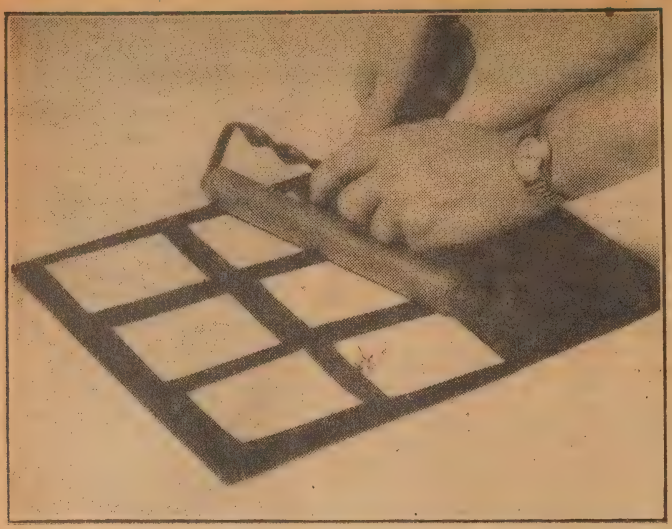
BRS MICROPHONE

DESIGNATED as the "Audio Cell" type B-46-D, a new crystal microphone has been released by Byer Industries Pty. Ltd., of 8 Dorcas Street, South Melbourne.

The microphone has a relatively high output and a response which does not vary by more than 6db. from 40 to 8000 cps. It can be used for

either distant or close-talking conditions, so that it is well suited for general public address, stage or recording work. The pickup pattern is non-directional in a horizontal plane and wind noises are slight.

Measuring 2¾" high by 2" diameter, the outer casing is a hard-drawn non-ferrous alloy, oxide coated and non-corrosive.



Showing how the rubber roller is used to roll the prints on to the ferrotype plate. A household wringer will do an even better job.

BE PROUD OF YOUR PRINTS

A feature which is characteristic of a good commercial print is the smooth, highly-polished surface. The author explains how this finish can be applied to your own prints and, for good measure, has something to say about contrast and the proper choice of printing papers.

by Philip Watson

AFTER washing there is one more process required to give your prints a really professional appearance. This is the glazing process, which gives that high gloss finish so necessary to preserve the fine detail in small prints.

It is achieved by the method of drying, which also produces prints having a slight curl, but free from the unpleasant buckles which usually result from ordinary drying.

Only "glossy" types of paper are suitable for this process, and after washing, and while still wet, they are pressed into close contact with some form of highly polished surface and allowed to dry in contact with it.

The paper manufacturer coats the surface of these papers with a special glazing emulsion, and while this is wet and soft it is moulded to the shape of the highly-polished surface. When it dries it retains this shape, giving it the well-known professional gloss.

TYPES OF SURFACE

There are many types of surface used for this work, such as glass, ferrotyped metal, chromium-plated steel and stainless steel, while some experiments have recently been conducted with anodised aluminium and perspex.

The chromium and stainless steel plates are capable of producing a very high gloss, but are rather expensive. They are, therefore, more popular with the professionals than the beginner. Glass will give a reasonable gloss, but prints seem to have a greater tendency to stick to this material than to any other. Another difficulty with glass is that of exerting enough pressure when applying the prints, without breaking the glass.

The ferrotype plate is about the most popular with beginners, being reasonable in price, giving a good quality gloss, and is free from sticking troubles, providing a few simple precautions are taken. From reports so far, the anodised aluminium shows promise of results at least comparable with the ferrotype, and the price should be in the same general bracket.

Perspex is not likely to be considered from a commercial point of view, but should provide the basis for some interesting home experiments. One disadvantage is that the surface is extremely soft, and it must be very carefully handled if its smooth polish is to be preserved.

Unfortunately, the only plates readily available on the Australian market at present are the stainless steel and chromium, but we believe that attempts are being made to produce both the ferrotype and anodised variety locally, and that they should be available shortly. In the meantime keep trying, as it is quite possible that there may be some odd stocks around.

In order to minimise the risk of sticking, it is advisable to coat the plate with a suitable preparation before applying the prints. There are many commercial glazing and stripping solutions available, which may be relied on to do a satisfactory job. For those who would like to make their own, the following can be thoroughly recommended:—

Dissolve approximately 1oz of paraffin wax in 8oz of benzine or cleaning spirit, and apply a few drops of this to the plate with a piece of cloth. Leave for a few minutes, until the spirit has evaporated, and then polish the remaining thin coating of wax with a soft, clean cloth. The writer has used this solution for many years, always with perfect satisfaction.

An alternative mixture uses carbon tetra-chloride in place of benzine, which has the advantage of being non-inflammable, but the fumes are rather unpleasant, particularly in confined spaces. Yet a third solution consists of beeswax and turpentine in approximately the same proportions.

BEWARE DUST

After the plate has been polished, the prints are taken from the wash water and laid face down on it. Cleanliness is all important at this stage, as any specks of dust will become embedded in the emulsion surface. If the plate cannot be kept free from dust until you have applied

the prints, it is quite in order to hold it under the tap and run a gentle stream of water over the surface.

When the print has been applied it is necessary to remove all surplus water, and apply considerable pressure to the back of the print to bring it into close contact with the polished surface. This is usually done by means of a roller type squeegee, which consists of a rubber-covered roller about six inches long and about an inch in diameter. It is mounted in a simple angle frame and fitted with a suitable handle.

Printed on high contrast paper, a normal negative produces a hard, flat image. Compare the result with the print on the right using medium paper. Some may prefer an even softer effect for a portrait.

In use, this is rolled back and forth over the backs of the prints, exerting as much pressure as possible. The surplus water is then drained away. One of the secrets of a good gloss is the application of sufficient pressure, but care must be exercised in this regard. Too much pressure may cause the roller to bind and, being forced across the damp print, may damage it.

Far better than all the rollers, if available, is the domestic clothes wringer. Screwed down hard, it will provide all the pressure required and the smooth movement of the rollers will reduce the risk of print damage to a minimum.

Once drying has commenced, no attempt should be made to coax the prints off the plate until they are quite dry. In fact, they are best left to lift off themselves, which they will usually do overnight.

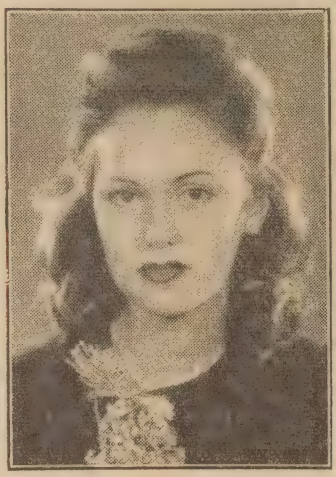
Artificial heat may be applied to speed-up this process, but except where this is very gentle, pressure should be applied to the back of the prints until they are ready to be removed. The heat should always be applied to the side of the plate away from the prints, and never to the back of the prints themselves.

Failure to observe this precaution will result in the back of the print contracting, as it dries, faster than the emulsion, curving the print away from the plate and peeling it off prematurely. This produces an effect known as "oyster shells," where the smooth surface of the print is broken by a series of concentric rings or ridges.

COMMERCIAL PRACTICE

Commercial drying and glazing machines hold the prints on to the plate by means of a canvas apron, and apply heat to the underside of the plate by means of a small element. They will usually dry a batch of prints in about 15 minutes. Stainless steel plates are normally used, and these seem to have less tendency to stick than most other types, so much so that many workers never use any kind of solution on these plates, their only precaution against sticking being to wash the plates occasionally in warm, soapy water.

Where irregular-shaped areas of the print appear to have little or no gloss, the cause is usually insufficient pressure of the squeegee. Small, almost round areas, are usually the



result of specks of dirt preventing the print from coming into contact with the plate at that point.

Sticking may be caused by dirty plates, particularly small particles of emulsion left from previous prints. Proper polishing and washing will usually prevent this. Prints which have not been hardened have a greater tendency to stick than those which have, so make sure that your hardening bath is doing its job properly.

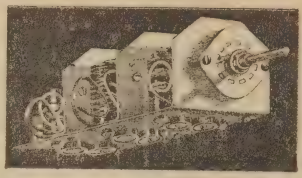
If you follow the above procedure carefully, you should have no difficulty in turning out a batch of well-glazed professional-looking prints, and one might suppose that we had come to the end of our story of elementary developing and printing.

However, this is really as good a

(Continued on Page 83)

MODERN VALVES NEED MODERN COILS

Australia's cheapest unit yet, for its type by far the most sensitive—less than 1u/volt on broadcast band and little more on short wave. Designed for high-stability and practical application. Available for most converter types.



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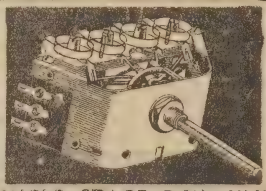
SPECIAL FEATURES INCLUDE

- Measures only 5½" x 2½" x 2¼"
- Lo-loss polystyrene former.
- Spherotune carbonyl tuning. (Exclusive to Q-plus).
- Spare contacts for gramo-switching.
- Available for 16-50M or 13-42M

This is the specially shaped midget unit, designed to snugly fit between volume control and dial spindle. Available for all wanted converter valves, but only for 16-50M short-wave coverage.



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- Lo-loss polystyrene former.
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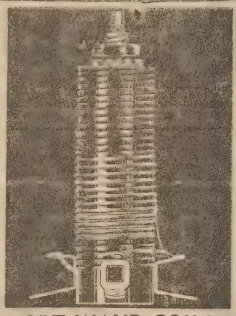
- Single hole mounting.

At last a highly efficient short-wave coil—professional in appearance and performance. This unit uses a special high-frequency carbonyl powder core — small in size yet ample to align for stray inductances.



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FEATURES

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- Single hole mounting.
- Normally priced.

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FOR BEST RESULTS WITH YOUR DUAL-WAVE UNIT INSIST ON Q-PLUS IF's

STANDARD

We recommend types I.F. 8 and 9 —the exclusive "SPHEROCLAD" I.F. With Opimum Gain and Selectivity Characteristics and Ceramicon Negative Temperature Condensers.

MINIATURE

Similarly constructed to the type 8 and 9—"Q Plus" miniatures — type Nos. 1 and 2 are recommended for all portable and miniature applications.

I.F. TRANSFORMERS

STANDARD

Definitely the best value available these "Spheroclad" coils have exceptionally high "Q" factors. Each unit has inbuilt top coupling condenser so necessary for uniform gain over the band

SIZE

7/41 Litz wound HI-Z primary, etc. Lo-loss base same construction for R.F. coils. Oscillator coils to match. And for use with all converter types.

AERIAL, R.F. AND OSC. COILS

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No need to repeat the success of these units in car radios, portables, etc. IMITATED BUT NOT EQUALLED

Please be sure you get the correct type—see opposite.

SIZE

RC1 normal midget R.F.
RC2 tapped (car radio type).
AC1 normal midget aer
AC2 tapped (car radio type).
O5 6SA7/6BE6 OSC.
O2 1R5 OSC.

SEE YOUR DEALER FOR OTHER DETAILS

AERIAL, R.F. AND OSC. COILS

MODERN COILS ARE "Q-PLUS" COILS

R. W. STEANE & CO. PTY. LTD. Auburn, Vic.

AN AC OPERATED SPOT WELDER

Following on the description last month of a battery-operated spot welder, this article describes the adaption of the unit for a-c operation. The main requirement is the provision of a suitable low-voltage high-current transformer.

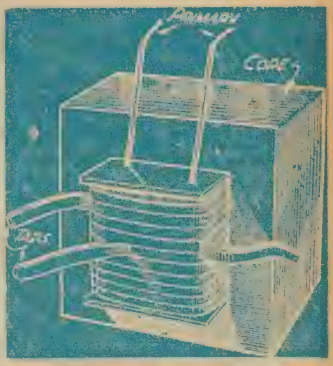

Fig. 1. (above)—The finished transformer.

BRIEFLY, the differences between the battery-operated welder and the mains operated appliance are that the latter machine is operated from a transformer and the finger push switch dispensed with.

A foot switch is used leaving both hands free to hold the work.

Start the work by removing the contact switch and then drill another hole through the bottom arm so that the whole may be bolted down to the bench or a large wooden base.

The transformer is the heart of the machine and must be made with care. A 500-watt transformer can be operated from a light socket and is heavy enough for most work, but a 1000 watt transformer imposes at least a 5 amp load and this wattage is too great for the lighting wiring.

THE TRANSFORMER

If possible, try to obtain a second-hand transformer with an open casing rated for your supply and with an output of over 500 watts. On conversion it will be as efficient as a commercial 500-watt transformer, and the work of the conversion will be easy.

The output required is a maximum of 100 to 200 amps, at 1, 1.5, 2, 3, and 5 volts. In watts this is 500 or 1000 depending on the current required in the home shop.

To carry over 100 amps, large cables are necessary, and as the resistance has to be kept very low we are using sections on the heavy side to allow for drops in voltage across joints, &c.

On a core of this size, which must not be less than 3.5 sq. in., we can allow five turns per volt; thus, one needs a total of 25 complete turns with taps at the 5th, 7½th, 10th, and 15th turn respectively.

The length of strip of suitable section is obtained, and, if hard drawn, is annealed. The section must not be less than 0.7in x 0.1in. It must be cleaned and then insulated from end to end with good quality tape. Do not try to economise by scraping off the tape from the section required for taps, but leave this until finished, and scrape off afterwards.

The taps are brought out as double lengths of wire to avoid soldering, &c., and they should be hammered flat so as to lie neatly together. The starting end is connected directly to the bottom bar as before, while the top bar has the flexible connector for use with the taps.

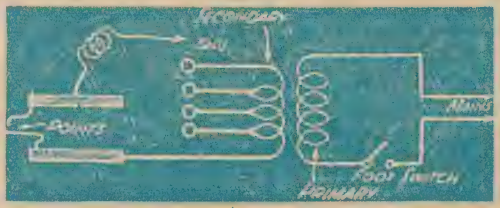

Fig. 2.—The circuit diagram.

TAPPING SCREWS

In making a tap, bring out the wire for 6in, bend it over on itself, and take it back and continue winding to the next tap. Remove the insulation from the bent end, clean the copper and press together, and then run solder between the two to make a solid bar.

Drill the bar and tap with a ¼in fine thread, and fit with a cheese-headed screw.

When the transformer is mounted on the base, the taps also are screwed down to the wood by two small wood screws, countersunk and passing through the copper, one in front and one behind the tapped hole.

The top surface of the copper is dead flat. A suitable washer must be used under the screw in order to make good contact.

When different tappings are often required, the screws are fitted with

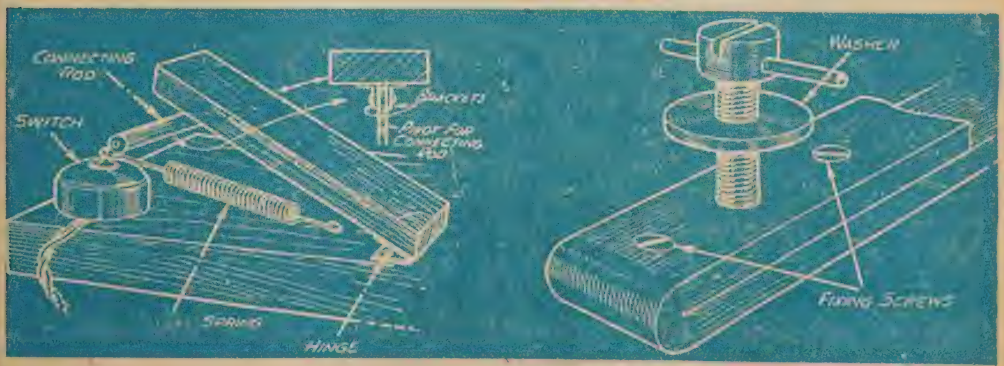

Fig. 3. (left)—Details of the foot switch and Fig. 4. (right)—The method of making the taps.

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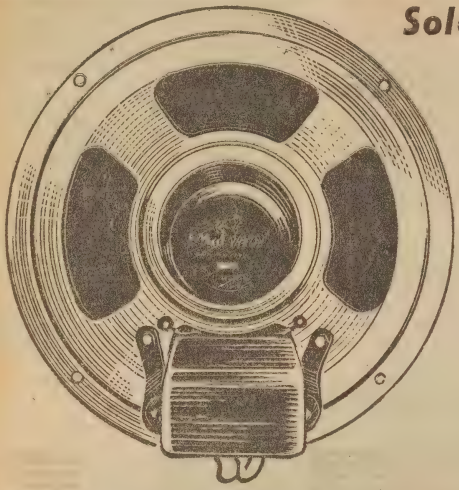

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All voice coils of 1" diameter and 2.7 ohms. impedance at 400 CPS.

All transformers are tropic proofed and interchangeable throughout the range.

Unique design enables damaged cones to be replaced easily and speedily.

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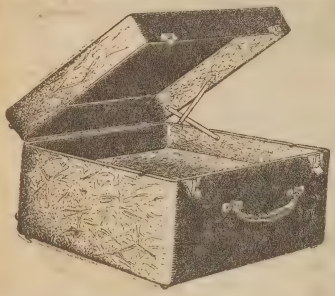
Full supplies available now



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Suitable for any make of record changer. Brown leatherette finish. **149/3**

Similar, but for single player motor and pick-up **116/-**

Small De Luxe type for Garrard "S" type motors. **102/-**

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For your Gram.: Brown Plastic in pairs. 1/10 pair.

"RECORDEX"

The new improved Grammo record rack.

- Holds 25 10" or 12" records.
- Engraved easy to read index strip.
- Complete with index card and gummed identification numbers for the records. **25/-**

New model for 50 records **33/-**

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Sapphire straight, trailer, or miniature . . . . . 13/6 each
Steel Needles . . . . . 2/3 per 200
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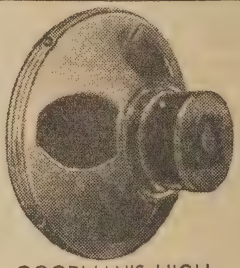

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New model.
Axiom 150 15 watt.
£17/12/-

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Trade also supplied **Open Saturday Mornings**

n easily turning head. Do this by drilling a 3-32in silver steel rod through it. The spade end of the connector is made to suit the taps.

Arrange the five taps in a neat ow behind the welder. Keep the eads as short as possible.

If a second-hand transformer is used, it is often better not to dismantle it, but thread the secondary hrough the spaces: this may sound edious, but remember you are deal- g with only 25 turns. It is a mat- er of minutes with the core clamped n a vice. The reason for this is hat we cannot reassemble the core nd clamp it tightly as the maker loes.

We have assumed that the prim- ry was suitable for your supply.

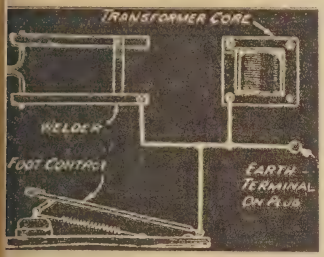


Fig. 5.—The connections for earthing the welder and the foot pedal.

f not you will have to rewind to uit.

Assuming a 240-volt supply this will mean 1200 turns.

The gauge of wire may be cal- ulated from wire tables, taking into account the primary current and he available winding space. In this ase it will be required to carry a urrent of approximately 5 amps.

Next calculate the core window rea after allowing for the secondary winding, and from the wire tables find the turns per square inch of the selected gauge. This will tell you whether there is enough room for the required number of turns of the wire selected. Since the rating is intermittent it should be possible to reduce the size of wire if necesary.

Winding 1150 turns on a fixed core when the wire is passed through and through is tedious work, but in this case you would have to dismantle the core and wind in the ordinary manner.

The foot switch will now be considered. Here we have the same idea as that used for closing the points. Mount both the Bowden Control to the points and the switch on the same base.

PEDAL SWITCH

The switch pedal is a piece of wood 3in wide and 9in long, and is hinged, at the end nearest the operator, to the base. The switch proper is a tumbler switch with a brass knob. It should be capable of carrying five amps, with a quick make and break. A cheap one will do quite well.

This is mounted under the pedal and is connected to it through a short brass connecting rod. Make a saw cut at right angles to the pivot in the knob, open it out with a file until it will take a 1-16 in. pin through the knob. The connecting rod, which is a strip drilled with 1-16in holes at each end, is cut from sheet brass 1-16 thick.

Put the switch in the off position, place the connecting rod in the knob and push the pin in; now work the switch by manipulating the knob.

The pedal must work the switch, and for this mount two small brackets on the under side of the wood, drill and put in the rod. The best position for the brackets and switch will be found by experiment, but it can be used with the bracket on the end of the wood and the switch about 2in from the end, the rod being 3in from centres.

SPRING LOADING

A strong spring is hooked round the knob and round a screw in the base so that the switch is always off. It should take quite a good pressure to close the switch, and on removing the foot it should fly open. Fig. 3 shows the finished switch. With this means, it is possible to get very accurate time control, and good work can be done. Twin flex from the switch is taken up with the Bowden wire to the welder base, and there connected to a porcelain junction box. This gives a neat and workmanlike finish. Fig. 2 shows the circuit.

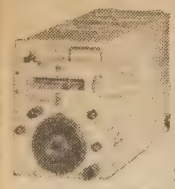
A simple press switch can be made from pieces of brass similar to a bell push, but we do not recommend this because of the difficulty of protection, &c. The whole welder MUST be earthed, and so must the foot pedal, &c. (See Fig. 5.)

Since the transformer is worked off the mains, and the little extra electricity used is not noticed, it is a good plan to arrange a small light just by the points. This should be a six-volt car side lamp with switch on the base, and is run from the 5-volt tapping.

Mount it on a small flexible arm, and cut a tin shade so that the light is exactly as required. It will dim a little when the 5-volt tap is used.

The Canadian Fisheries Research Board advises fishermen to use small bait when the water is cold and larger pieces when the water is warm. Fish swallow larger pieces of food in warm water.

WESTERN-ELECTRIC COMMAND TRANSMITTERS



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Price, complete with valves and crystal **£6/17/6**

Packing and postage: N.S.W., 2/9; Qld., Tas., Vic., 5/-.

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Ideal voltage control for aircraft and home lighting, generators, etc PRICE, each **50/-**

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BENDIX 100 WATT TRANSMITTER—TYPE TA12

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Valves — 6N7—6F6—Push-pull 807. Power output—50 watts Audio. Complete with Modulation output transformer and dynamotor supply. Input 25v. D.C., 14.8 amp. Output, 540 volts, 150 mA. Price, F.O.R. **£17/10/-**

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1K7G	8/6	955	12/6
3Q5GT	10/-	956	12/6
6AC7	14/-	9001	10/-
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6SH7	8/6	12SK7	10/-
6SH7GT	8/6	12SR7	10/-
7193	8/6	EA50	7/6
852	25/-	CV6	8/6
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NEW VALVES

1D8GT	15/-	811	70/-
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6J5G	11/-	879/2X2	15/-
6SQ7	12/6	1294	11/6
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7C7	11/6	VR65A	5/-
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Ideal for A.C. Meters and Multimeters, etc.

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BATTERY CHARGER RECTIFIERS

12-volt, 5 amp 39/6

12-volt, 1 amp 25/-

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12-volt, 40 amp, D.C. (F.O.R.) Each **£9/10/-**

Ideal for home lighting plants, battery charging, plating, etc.

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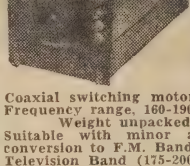


Complete with 11 valves: 2—R.F. stages, 954 acorns, mixer and oscillator, 2—955 acorns; 30 mcs, I.F. channel. 4—6AC7's; detector 6H6; cathode follower 6AC7; rectifier 5V4G.

Coaxial switching motors 24-volt D.C. Frequency range, 160-190 mcs.

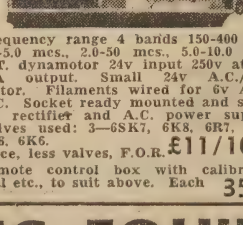
Weight unpacked, 30lbs.

Suitable with minor alterations for conversion to F.M. Band (88-108 mcs.). Television Band (175-200 mcs.). 144 or 288 mcs. amateur bands.

Complete with valves as above in vented metal case, size 7¼ x 8½ x 18 inches.

PRICE, F.O.R. **£8/15/-**

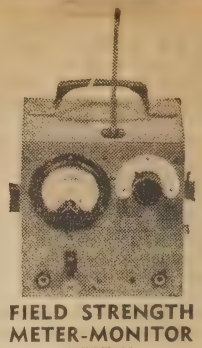
BENDIX AIRCRAFT COMMUNICATIONS RECEIVERS RA10FA



Frequency range 4 bands 150-400 kcs. 2.0-5.0 mcs., 2.0-50 mcs., 5.0-10.0 mcs. H.T. dynamotor 24v input 250v at 100 mA output. Small 24V A.C./D.C. motor. Filaments wired for 6v A.C./D.C. Socket ready mounted and space for rectifier and A.C. power supply. Valves used: 3—6SK7, 6K8, 6R7, 6C5, 6H6, 6K6.

Price, less valves, F.O.R. **£11/10/-**

Remote control box with calibrated dial etc., to suit above. Each **35/-**



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Frequency range 100-130 mcs. or can be converted to any other freq. range by altering one coil. Complete with 1N5G valve, imported 3-inch 0-1 mA meter and chrome-plated telescopic aerial. Jack provided for using meter for external measurements, also necessary plug and lead. Batteries encased within the unit. Size 6½ x 7 x 7 inches. Supplied in portable carrying case.

Price, New, Complete, less batteries, F.O.R. .. **£4/10/-**

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Colour: Blue. Length, 5½ inches. Ideal R.F. indicators.

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Field type, complete with magneto, bells and sound-powered push-to-talk handset (no batteries required). Mounted in metal carrying case with strap. Size 10 x 5½ x 4½ inches. Brand new in original sealed cartons.

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5-pole each 2 pair of contacts. Made in USA. Ideal for receivers, multimeters, etc.

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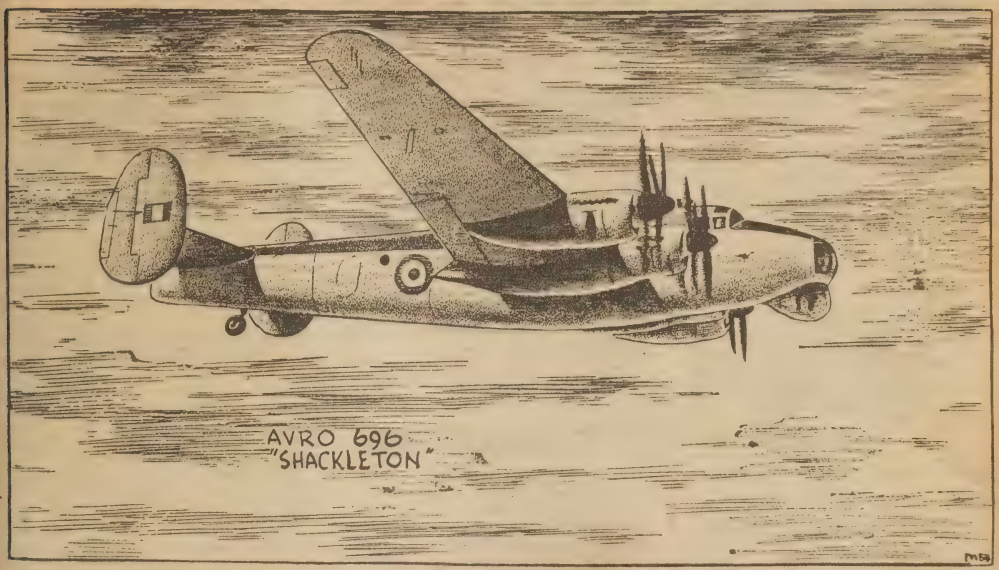


Designed and equipped specifically for maritime reconnaissance, the Avro 696 "Shackleton" is one of Britain's interesting new aircraft with a vital role—maintaining command of the sea.

WHEN the prototype Shackleton made its first flight just two years ago, it became the first British four-engined aircraft to fly with contra-rotating propellers.

The Shackleton is derived from the Avro Lincoln, the RAF's notable heavy bomber. Compared with the Lincoln, the Shackleton has substantially the same wing and landing-gear, but a completely new fuselage and tail unit.

Reconnaissance of the type for which the Shackleton is designed entails hours of constant patrolling —an operation demanding unwavering vigilance and alertness. To assist in its work, comprehensive radio and radar equipment is carried. These make all-weather operation possible.

RADAR EQUIPMENT

The radar scanner is contained in a perspex housing beneath the nose.

Provision for de-icing includes fluid de-icing on the wings, tailplanes and fins, airscrews, bomb-aimer's window and pilot's windscreen.

A cantilever mid-wing monoplane, the Shackleton has a fuselage of light-alloy stressed skin structure. The bomb-bay has "clam-shell" doors.

The tail unit consists of a cantilever monoplane tail and end-plate fins and rudders.

Main landing wheels, carried between oleo-pneumatic shock-absorbing legs, retract backwards into the inner engine nacelles. A single fixed tailwheel is carried in a forked shock-absorbing unit.

Provision is made for a crew of 10. The pilot's compartment, in the forward section of the fuselage, seats two side-by-side. Other crew positions are in the nose and fuselage. Defensive armament is listed as two 20mm cannon in a remotely-controlled turret located on the top of the centre section of the fuselage.

No details on weights or performance have yet been made public.

Power is provided by four Rolls-Royce "Griffon 67" 12-cylinder Vee liquid-cooled motors. Each motor drives a de Havilland eight-blade contra-rotating constant-speed full-feathering airscrew of 13ft diameter.

Main dimensions of the Shackleton are: Wingspan, 120ft; length, 77ft 6in; and height, 17ft 6in.

GRID-DIP OSCILLATOR

(Continued from Page 59)

hand. The right hand is then free to operate the dial.

Ray mentioned several methods of calibrating the instrument and if you do not have a signal generator available one or other of these can be used. With a signal generator, the calibrations of which are reasonably correct, the job is made easier.

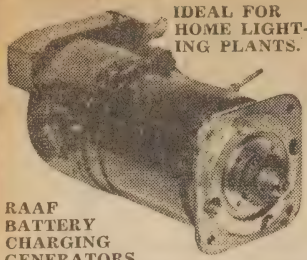
Plug a pair of phones into the plate circuit jack and connect the output of the signal generator into the grid circuit jack. Wire a resistor (about 2000 ohms is suitable) in parallel with the grid jack to complete the circuit. With the output of the signal generator adjusted to a suitable level it will be possible to hear a distinct beat note between it and the grid-dip oscillator. Be careful not to use too much output from the signal generator, since it may cause the grid-dip oscillator to "pull in" to the same frequency and thus prejudice the accuracy of the calibration.

Most signal generators only cover to 30 Mc. so that it will be necessary to use harmonics of the generator for the highest range. The tuning becomes more critical and more output is required from the generator but there is no real difficulty.

The completed instrument is one of the most useful in my workshop and well worth the time and effort taken to build and calibrate. Having once used it to make a set of coils for a receiver or a multi-stage transmitter you would never again be satisfied with the old-time consuming, cut and try methods.

DO YOU KNOW?

Glauber's salt is being used in a Massachusetts experimental house to store solar heat until needed to heat the house; the heat of the sun liquefies it, but the heat is given off when the salt solidifies later.



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Brand New English Lucas, 12 volt 500 watt £10/15/-

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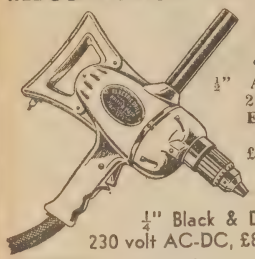

British Made "Wolf" ¼" AC-DC 230 volt Electric Drills, £15/3/9

Also ¼" Black & Decker 230 volt AC-DC, £8/19/6

Never again at these prices. Brand new. Limited stocks available.

Grinding and Buffing Sets to suit Black and Decker Drills 25/-

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Useful for Gas Torch 55/-

Glass Blowing or Tinning, etc.

BRAND NEW AMERICAN PUMPS

USED BY THE R.A.A.F.

WILL PUMP ANY LIQUID

STAINLESS STEEL VANES

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200 gals. per hour 50/-

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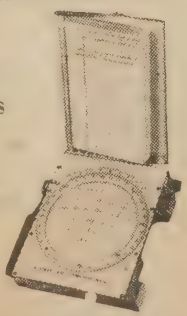
DALTON COMPUTORS IDEAL FOR AERO CLUBS A.T.C., ETC.



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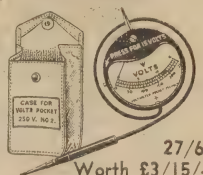

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2.2 cubic feet, will pump up to 75lb.

Never before at this price.

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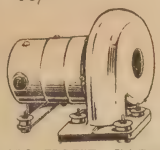

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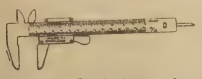

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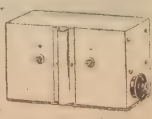

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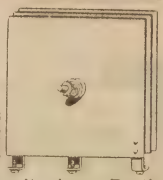

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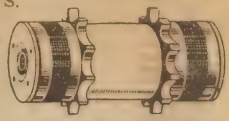

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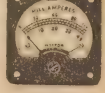

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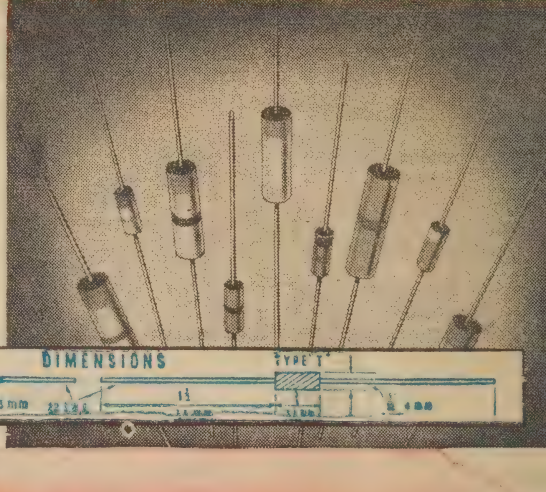

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BE PROUD OF YOUR PRINTS

(Continued from Page 73)

time as any to take stock of your results. Are they as good as the best you have had done commercially?

Well, not quite. One in particular is rather disappointing. It was taken on a dull day, but the negative looked good, and I was hoping for a nice print. Instead, it looks flat and lifeless, just a series of grey tones. Is it to do with the contrast or something?

Yes, it is to do with the contrast. You see, under dull conditions the light is very diffused, there are no sharply-defined shadows, and the contrast of the scene is much reduced. Even though you increased the exposure and produced a well-exposed negative, this does not compensate for the reduced contrast.

Does this mean that I should not take pictures on a dull day?

Certainly not. Such lighting has many advantages, the comfort of your model being one of them. But the contrast will have to be increased. There are two ways of doing this. You can increase the development time of the negative, or use a more "contrasty" grade of paper.

OBVIOUS DIFFICULTY

Naturally, you can't very well increase the development of one negative in the middle of a roll.

No, but you can use a different grade of paper. I would suggest a No. 3 in this case.

Will the printing exposure and development be the same?

The development, yes. But the exposure will probably be different. Until you gain some experience in the relative speeds of the different grades, you had better start from scratch again and make some test strips.

What about the other grades of paper? When will I need those?

The No. 1 has a very low contrast, and is for use with a negative which has more than normal contrast. These don't happen very often, unless you accidentally over-develop a film, but you won't have any difficulty recognising one when it does. Printed on a normal paper, it produces an effect known as "soot and whitewash." In other words, the picture consists almost entirely of pure whites and dead blacks, with very few intermediate or grey tones. With a little practice you will learn to recognise these negatives without making a print.

EXTREME CONTRAST

And the No. 4?

This has a very high contrast, and is really intended for the near-failure negative, or one which has a very low contrast. Such a negative may result from a bad case of under-development, or often from under-exposure. In the latter case it will also suffer from lack of detail in the shadows and, while the correct grade of paper may partly restore the contrast, it cannot put detail in the print when none exists in the negative.

I'd like to get a few points clear about this negative contrast business. Has it anything to do with the density of the negative?

Not very much, really, although the two characteristics are often confused. The contrast is simply the difference between the thinnest and densest portions of the negative. When the dense portion is almost completely opaque, and the thin portion almost clear celluloid, the negative is near its maximum contrast.

OTHER EXTREME

And the low contrast case would be the reverse of this?

Yes, the difference between the thin and dense portions would only be slight, and this ratio could be identical in two negatives which had quite different densities.

Does this mean that these two negatives could produce identical prints on the same grade of paper simply by altering the printing exposure?

Exactly. And it also shows how futile is the "development by inspection" technique. About the only thing you can see by inspection is the density, and this has no bearing on the contrast, the factor which we are trying to control.

Then what does control the density?

For all practical purposes, it is the exposure. Admittedly, the development will have a slight effect, but it is so slight that variations in exposure completely mask it.

Suppose all my prints had shown what you call "lack of contrast," even though the lighting had been normal. What would be the likely cause and recommended cure?

UNDER-DEVELOPMENT

The cause would almost certainly be under-development, which in turn may be due to insufficient information regarding the developer, an error in timing, an error in calculating the development time for the prevailing temperature, or failure to measure the temperature correctly. However, if you are sure that all your measurements and timing were correct, it simply means that the developer is not doing its work as quickly as you thought, and more time should be allowed.

How much increase would you suggest?

Probably about fifty per cent would be required to make a worth-while change, and some minor changes could be made after that, depending on results.

Could such a batch of negatives be salvaged by using a more contrasty grade of paper?

They could, but, of course, subjects which had a naturally low contrast may present something of a problem, which is why you should always aim to accommodate your average negatives on a medium grade of paper.

SHORT WAVE NOTES BY RAY SIMPSON

POOR RECEPTION ON NEARLY ALL BANDS

Conditions during the past few weeks have been about the worst we ever remember and stations which normally, at this time of the year, would be heard at good strength are coming in very weakly. This even applies to the BBC and some of the American stations for much of the time.

THIS present phase of reception is apparently not confined to Australia as, according to Ken Boord, of the USA, he has heard from listeners in many parts of the world, all complaining of poor reception.

Occasionally, of course, conditions improve for a short period when everything comes good again. The spell may last for a couple of days, only to be followed by another spell of poor reception. Generally speaking, we have found that the 25 metre band is the most stable of the lot and toward midnight there are quite a number of signals which can be heard.

The higher frequency bands are very disappointing, however, and as far as the 13 metre band is concerned, the only worthwhile signals we have heard are from All India Radio, which, on some nights, reaches very good level. Let us hope that in the near future conditions will improve and thus enable us all to enjoy good listening.

NZ YACHT ARGO

AS we write these notes quite an interesting radio drama is taking place in New Zealand, where efforts are being made to find the location of the yacht Argo, which has been missing for 10 days. This yacht was taking part in the Wellington to Lyttelton race and has been missing since that time after having run into a severe storm. The first word from the yacht came with the reception of weak signals heard by about half a dozen listeners in various parts of New Zealand. Signals were so weak it was impossible to definitely identify the yacht and were not strong enough to enable the direction finders to pin-point her position.

Many of the NZ radio amateurs were maintaining a radio watch in an effort to log the signals from the yacht, while the Auckland radio station was transmitting signals on 2.182 Mc for a period of 10 minutes with a request that if the yacht heard them it was to reply with a series of dots. According to some of the amateurs we heard they seemed to be hearing faint signals on 2.012 Mc, which they thought were being sent out by R. Fielding, the radio operator on the yacht. We tried at our location, but we could not even hear Auckland, so, naturally, we were not able to intercept anything from the yacht. Let us hope they will soon be located as they must have had a very trying time.

SIRA, ARGENTINE

SINCE the Buenos Aires stations commenced their transmissions in English under the control of the old SRI they have gained many friends throughout the English speaking world as previously to this policy they had only been heard with programmes in Spanish, which to many listeners was difficult to understand and also not very entertaining. For some time now they have been sending out their programme schedule in the form of a very attractive little booklet, which, in addition to giving their programmes, contained many fine photographs of Argentine beauty spots, architectural masterpieces and other views of interest to overseas readers.

Toward the end of last year the SRI changed their title to SIRA, which stands for Argentine International Broadcasting Service, and by a mail which arrived today we received a little pamphlet which we will quote in full:

"Dear Listener,—

"As from the 1st January next, the Argentine International Broadcasting Services, SIRA, ex SRI, will transmit in accordance with different timetables and frequencies to those in effect at present. For this reason our October-November programmes will be extended to December, inclusive. In that month (December) we shall broadcast a series of new programmes which we have no doubt will prove of interest to you, such as Argentina at the Half Century, Our Programmes Throughout a Year, Panorama of the Artistic Season in Buenos Aires, Yearly Sports Review, The Amateur Theatre In Argentina, Southward Bound, and outstanding events of the year in Argentina. The times at which these will be transmitted will be announced through the intermediary of our Press service.

"Once again, dear listeners, we invite you to send us your valuable criticisms of our programmes, pointing out both our errors as well as our successes. SIRA, the Argentine International Broadcasting Service, which sincerely desires your friendship, thanks you in advance for your collaboration in this respect.

"Our programme pamphlet containing the new timetables and frequencies for 1951 will be in your hands within a few days.

"Abel Orlando Figun,
"Chief of SIRA."

Up to the present we have not received their revised schedule, but note that station LRA, on 9.68 Mc, which has a power of 100 Kw is now also in the network of SIRA and we still hear LRY, on 9.455 Mc, with a programme in English in the early afternoon, though of late we have not heard the stations in the 25 metre band.

VERIFICATIONS OF THE MONTH

CARD FROM THE U.N.

WMF38 AND KUH27, USA.

Readers will remember we mentioned the special broadcasts which were given from WMF38 on 8.93 Mc and KUH27 on 17.9 Mc for the benefit of the Australian Broadcasting Commission preparatory to the latter organisation rebroadcasting the Chinese language programmes of the United Nations Radio. We have now received our verification for the above two stations and it is, of course, on the usual blue and white United Nations card. Normally, these stations will not verify when written to direct but apparently the thing to do is send your report to the United Nations when they are providing the programme.

HI2A DOMINICANA.

Verifications from the Dominican Republic are rather hard to come by as quite a number of them do not seem to verify at all while others only seem to favor a few lucky listeners. It was, therefore, quite nice to know that HI2A of Santiago, is one of those who do verify and they send out quite a nice card showing their call letters in red at the top, verification details in Spanish below, and then on the reverse side their slogan, La Voz de la Reeleccion, together with a radio mast, cloud, and call letters again. HI2A transmits on 9.68 Mc and can still be heard on some days.

YV1RV, VENEZUELA.

Venezuela is a South American country with a great number of short-wave stations, most of which operate in the 60 and 90-metre band. One of the best heard is YVMA on 4.75 Mc, who have just sent along their verification card. They are still using old cards as the one we received showed their old call letters, YV1RV for short-wave and YV1RA for the broadcast band. The card is in green, blue and white and shows call letters, also a map of the country with a radio tower superimposed. Verification details are also shown and the card is signed by L. Garcia Nebot. Their slogan is Ecos del Zulia.

Month's new stations

ITALY: After having been somewhat dormant for a few months regarding new channels we now notice that Rome has evidently begun a fresh series of experiments and it would, therefore, be wise to watch all the usual wave bands to see where they next turn up. The only new one we have found so far is on 5.06 Mc where they are coming in at good strength between 6.30 am and 7 am with the usual interval signal on the hour. The programme is in Italian but is easily understood. Do not mistake Rome for the Vatican City HVJ, which is also on the air at the same time on the adjoining channel of 5.97 Mc.

USA: Some months ago we reported hearing the General Electric station KGEI operating on 6.155 Mc and duly sent along a report to the station only to be told by them that they were not transmitting on this channel. Despite this denial, we are again hearing them on this announced outlet at 5 pm when they give the news in English. In addition to 6.155 Mc we are now hearing them on another channel in the 49-metre band, namely 6.075 Mc, and they transmit in English on this frequency between 8.30 pm and 9 pm when they give their call letters and frequency. We trust they will acknowledge that they are really on this new frequency as there is certainly no doubt about it.

PARAGUAY: It is a very long time since we have had any reference to stations in Paraguay as this South American country does not seem to have many short-wave transmitters. However, on a recent Saturday morning we managed to hear ZPA3 in Asuncion with a programme on 11.853 Mc. They were first heard just before 9.30 am and at the half-hour gave their call as ZPA and ZPA3. Their slogan is Radio Teleco, but we did not distinguish this in any of their announcements though the call letters were quite clear though, of course, were in Spanish. It may be worth while to keep a watch for this station as we imagine it will be rather elusive and not heard with any regularity.

FLASHES FROM EVERYWHERE

AUSTRALIA: Thanks to information we have received from Mr. Fergus J. Smedley, of Landsborough, Queensland, we are able to give some news regarding the Brisbane short wave station VLM. During the first week of January frequent announcements were made over the Queensland medium wave stations asking for reception reports on VLM and also a further announcement that the power of this station would be increased to 10 Kw as from 25th January, 1951. Possibly, the coverage of VLM had not been as good as expected, hence the increase in power. It is certainly heard at good level here in Sydney.

PORTUGUESE GUINEA: This is not a country which is reported very often. In fact, it has never been heard at all at the writer's location, though attempts have been made on various occasions. One of our Victorian listeners, Mr. Alexander Talbert, has just sent us some details he has received direct from the station in which they state they are now operating on 5.838 Mc from 7 am to 9 am EAST, with a power of 1000 watts. On a favorable morning it might be possible to log them when they open at 7 am, but we think the chance would be much better if they were using their alternate frequency, just below the 7.0 Mc band. We shall be interested to hear from anyone else who hears this station, CQM4.

SPAIN: With the exception of Radio Nacional de Espana, on 9.369 Mc, which can always be heard at good strength, both in the mornings and also at 1 pm, the Spanish stations have always been rather hard to follow, or, at least, identify. There are quite a number in the 7.0 Mc band which are in relay at 6.45 am with the news and give their individual identification before and after.

From Sweden, calling DX ers we note that Radio Falange de Alicante has now taken into use a new frequency, 9.045 Mc in addition to their normal channel of 7.94 Mc. Radio Almanza is a new station, using 7.275 Mc, and is heard in England around 8.30 am EAST.

GREECE: From a recent issue of the Universalite we note that the Greek Armed Forces Radio Station in Athens, which transmits on 6.34 Mc, is carrying out experimental programmes in English daily from 2.15 pm to 2.30 pm and 7.15 am to 7.30 am. Reports on these transmissions are welcome and should be sent to Armed Forces Radio Station, No. 3 Zalacosta Street, Athens. In one of the DX sessions from Radio Australia we heard an item advising that Athens was now also being heard on 6.175 Mc from 3 pm to 5.30 pm. At our location we are still hearing Athens at quite good strength in the late afternoons when they use 9.605 Mc, Sundays being the best day on which to hear them.

ECUADOR: We always think that there is never any excuse for not being able to log a South American station so long as we have HCJB in Quito, Ecuador. This real old-timer can be heard any day on practically all their frequencies—5.99 Mc, 9.958 Mc, 12.455 Mc, 15.115 Mc and 17.89 Mc. Around 7 am the best channels are 9.958 Mc and 12.455 Mc when the programme is in English, while the Spanish programme can be heard on 5.99 Mc. In the early afternoon we have heard this station broadcasting in Russian on 12.455 Mc, while at night they can sometimes be heard in Swedish. They are always anxious for reports and send out some very attractive verification souvenirs.

SYRIA: We do not hear very much from this country, though a few months ago they were being heard quite well in both the 7.0 and 9.0 Mc band. According to advice received from the station it would appear that they are now using 6.0 Mc, 7.145 Mc and 12.0 Mc, with English at 9 pm and 7.30 am. The 9.55 Mc channel is not now in operation. There are two stations in operation, both of 20 Kw, and their assigned frequencies are 7.145 Mc, 9.55 Mc, 11.805 Mc and 17.745 Mc, but they do not adhere very strictly to them. They like to hear from Australian listeners and reports should be sent to the Syrian Broadcasting Station, Jamal Pasha Street, Damascus, Syria.

NEW STATION LOGGINGS

Call	Kc.	Metres	Location	Time Heard
F.B.S.	3305	90.7	Malta	6.00 am
ROME	5960	50.35	Rome, Italy	6.30 am
KGEI	6075	49.38	San Francisco, Cal. USA	8.30 pm
VATBX	6280	47.76	Sunderland Flying Boat	5.00 pm
VATBX	6630	45.22	Sunderland Flying Boat	6.00 pm
ZPA3	11853	25.31	Asuncion, Paraguay	9.30 am
F.B.S.	15125	19.83	Malta	6.00 am

BROADCAST FROM FLYING BOAT

ON Sunday afternoon, January 28, a very interesting broadcast was heard from one of the Sunderland Flying Boats operating from Rose Bay, Sydney. This broadcast covered a full scale rehearsal for a thought reading programme which was to be given over a local commercial radio station on the same night.

When first heard the transmitter on the flying boat VHEBX was operating on 6.28 Mc carrying out tests with VIS on 6.405 Mc and then later in the afternoon when 6.28 Mc was being used by small ships, the flying boat changed frequency to 6.63 Mc and VIS to 6.505 Mc. The Sunderland was using the call letters VATBX and the signals, both on the water and while flying over Sydney, were very good indeed. Quite apart from the nature of the broadcast, which was something out of the ordinary, it was a very good example of the time and care which are taken to ensure that the programme as heard by the public on their normal broadcast receivers is free from faults and of good entertainment. We listened to the programme as originally transmitted on the above frequencies and then again to the recording given on the broadcast band.

In case listeners may think there was any trick in what they heard we would like to state that even though the programme was rehearsed more than once, the items of mind reading were different to those during the actual broadcast. This being the case there could be no suggestion of any pre-arranged order in the questions and answers.

Both from an entertainment and general interest point of view, this reception was one of the best we have ever heard and hope that other listeners also may have been lucky enough to tune in to VATBX while it was in progress.

SHORT WAVE NOTES for the April issue are due on March 10. For the May issue they are due on April 7. Please send them direct to Mr. Rev Simpson, 80 Wilga Street, Concord West, NSW.

NEW ADDRESSES

HVJ: Radio Vaticano, Citta del Vaticano, Italy.

YUA: The Radio Committee of the Federal Peoples' Republic of Yugoslavia, Belgrade, Yugoslavia.

ZEAF: Broadcasting House, Manica Road, Salisbury, Southern Rhodesia.

CR7IB: Emissora do Aero Clube da Beira, Caixa Postal 3, Beira, Mozambique.

VJUSE: Mauritius Broadcasting Service, Forest Side, Mauritius.

YDO: Radio Indonesia, Studio-Bandjermasin, Marinelaan, Bandjermasin, Borneo.

YDJ: Radio Republik Indonesia, Kampementsweg 6, Djogjakarta, Java.

VLT5: Australian Broadcasting Commission, Port Moresby, Papua.

CKFX: Western Broadcasting Co. Ltd., 543 Seymor Street, Vancouver, BC, Canada.

CFVP: Voice of the Prairies, Ltd., Toronto General Trust Building, Calgary, Alta., Canada.

COJK: La Voz de el Camagueyano Camaguey, Finlay 4, Havana, Cuba.

COCW: Cadena Roja, Prado 53, Havana, Cuba.

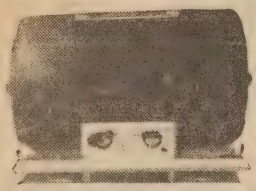
HRD2: La Voz de Atlantida, Avenida 14 de Julio, La Ceiba, Honduras.

XETT: La Hora Exacta, Dolores No. 17, 4/to Piso Mecico DF, Mexico.

YSUA: Radio Mil Cincuenta, La Avenida Sur No. 50, San Salvador, El Salvador.

DENMARK: Immediately Mr. Keith H. Howard, of West Cessnock, NSW, read our par on Greenland in the February issue of R & H he sent along a letter giving us details he had just received direct from the Danish State Radio. They list OXI in Gothaab as operating on 5.942 Mc with a power of 1 Kw and regarding the Danish stations they say: "For our transmissions beamed to the Far East is used a directional carpet aerial with reflectors of the type H2/4/0,75. The main beam direction is 88.5 degrees true north. The unmodulated carrier wave supplied to the above aerial mounts to 50 Kw. Ordinary class B modulation is used with sufficient efficiency for 100 per cent modulation of the carrier wave." Many thanks, Mr. Howard.

AMATEURS—DISPOSALS—EXPERIMENTERS



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Complete with 7193 valve, ready for use. Tuned by a split stator condenser worth this amount alone. An excellent driver for your 144 m/c Transmitter. Alternatively, modulate the unit as it stands.

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American type, plastic covered in ¼-mile rolls. Perfect for use with the phones at left.

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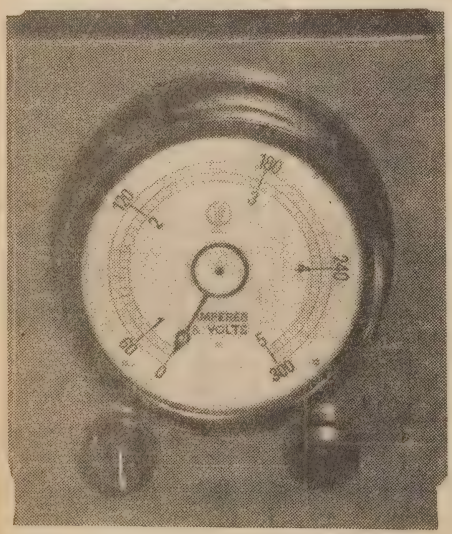

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Address all mail to—
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THE HAM BANDS WITH BILL MOORE

The NSW Division of the Wireless Institute of Australia celebrated over Australia Day weekend in January, the 40th anniversary of its foundation. During this period the council presented for members the "First Annual Hamfest."

SINCE its inception in 1910 the division has always endeavored to effectively represent the NSW Radio Amateur and with a membership above 800 is in a strong position.

The varied programme attracted many visitors and members and all functions were well attended. The event would be the biggest of its kind yet held in the Commonwealth.

Proceedings commenced on the Friday evening when 250 members and their wives were the guests of Amalgamated Wireless (Australasia) Limited) at their Ashfield Factory, where a Television demonstration was presented.

TELEVISION DEMONSTRATION

The Works Manager Mr. Fleming welcomed the visitors and handed over to the State President Jim Corbin VK2YC who expressed appreciation at the number present especially the galaxy of ladies—it is not often amateur radio can offer entertainment for the fair sex.

Mr. W. W. Honner, chief of the research laboratory, then explained the development and principles of Television, and reviewed the equipment on display. The speaker was televised while speaking, and most of the audience watched him on the receivers arranged round the hall.

After the serving of supper those present were able to inspect the equipment and the demonstration was of great interest to all

The Assistant General Manager of the company Mr. E. A. Horner who was present met members of the Council and a vote of thanks for the interesting evening was moved by the President and seconded by Past President Ray Priddle VK2RA.

The Saturday session of the Hamfest was divided into two sections. During the afternoon 80 members gathered at a demonstration of amateur equipment at Federation House. The meeting was informal and provided everyone with an opportunity of meeting country visitors.

Present from outside the State were ZL2VR and VK4ADC.

First to the rostrum was Angus Robertson VK2IQ to answer any technical questions on radio. Angus is never at a loss for an answer and swiftly dealt with all inquiries in his able style.

Cess Cronin then demonstrated and described some of his beautifully built 576 Mc. equipment.

The next piece of equipment on display was a turret switched receiver brought down from Cessnock by Jack Hill VK2ADT. The receiver has quite a reputation and city members were very pleased to have an opportunity to inspect it. The receiver covers all amateur bands 50 to 3.5 Mc.

LECTURES

Ray Howe VK2ARH then described and displayed those two valuable pieces of ancillary amateur equipment—the grid-dip oscillator and the antennascope. Amateurs present were impressed with the value of the combination in supplying the answers for anntenna problems. The antennascope was a combined effort by VK2HI, 2ABB, 2AC and 2VN who were responsible for design and manufacture. Joyce Jira VK2AMJ took charge of the afternoon tea arrangements.

The second portion of the Saturday session was the Annual Dinner for 1951 when 150 members and guests gathered to commemorate the 40th year of the division's foundation.

Guests included the Postmaster-General The Hon. T. L. Anthony, Mr. J. Malone chairman of the overseas telecommunications commission (Aust.)., Mr. Tom Court president of the I.R.E., Professor Bailey, Professor of Experimental Physics Sydney University, Mr. T. Armstrong, Superintendent Wireless NSW., and Dr. Adcock, Life Member and inventor of the Adcock D. F. System.

The Newcastle Branch of the Division was represented by the President Lionel Swain VK2CS.

The toast of the NSW Division was proposed by Mr. J. Malone who with his great understanding of amateur radio complimented the division on its activity and pointed out that he had been associated with W.I.A. functions for 30 years. He stressed the value of the amateur in emergency and National service, with special reference to the pre-war RAAF Wireless Reserve.

Jim Corbin VK2YC President of the NSW Division replied on behalf of the Institute. He pointed out that amateurs were still pioneering on radio frequencies, as the Tasman had been bridged for the first time on the 144 Mc band on the previous Sunday. He also stated that Radio Amateurs were always willing and ready to work for the welfare of the Nation in emergency.

Federal Councillor John Moyle VK2JU welcomed the Postmaster-General and proposed the toast of the department. He mentioned that the Radio Amateur was pleased to make personal contact with Mr. Anthony and felt that even more cordial relations would now exist between the W.I.A. and the department.

Mr. Moyle stressed the fact that amateurs in NSW. appreciated the co-operation afforded them by the superintendents in NSW. Mr. W. T. S. Crawford in the past and Mr. T. Armstrong at present.

The Postmaster-General Mr. T. L. Anthony in reply expressed pleasure at having the opportunity of addressing the gathering and during his speech covered many points of interest to Radio Amateurs. He said he appreciated the potential value of the movement as a source of technical personnel at all time. Shortly Television would be introduced in this country and undoubtedly many amateurs would be active in that sphere.

The Minister requested that in the interests of the Nation we should encourage the younger generation in the hobby. Finally Mr. Anthony expressed the thanks of his Department and the Government to the Radio Amateur for the work they have performed in the past during floods and bushfires.

KEMPSEY FLOODS

He especially mentioned the disastrous floods at Kempsey and on the North Coast in mid-1950 when he had an opportunity of meeting Radio Amateurs who had performed such work.

Mr. Anthony stated the movement could expect the assistance of the Government in all matters of National interest.

Past President Morrie Meyers VK2VN welcomed the visitors on behalf of the Division and Mr. Tom Court President of the I.R.E. replied.

The dinner was an unqualified success even under the restricted lighting that was evident at the time.

On Sunday 100 members and their wives gathered at Lane Cove National Park for a Picnic Field Day. The weather although unpleasant early in the morning settled down later in the day.

VK2WI operated in the Field Day and other equipment on 7 and 144 Mc was in use.

The Council appreciated the manner in which members supported all functions during the "Hamfest" and everyone is assured that a similar event will be conducted next year.

THE NORTH COAST CONVENTION

THE organisers have arranged a comprehensive and interesting programme for the Second Anniversary North Coast Amateur Convention of the W.I.A.

As usual the convention will be held at Urunga over the Easter weekend, March 24th. 25th, 26th and 27th. It is anticipated that a record crowd will be in attendance.

The programme is as follows:—

Friday March 23rd:—Registration only—if you register early you will assist the committee. Registration Fee—10/-.

Saturday, March 24th:—10 am to 1 pm registration at the "Do Me." Ladies' and gentlemen's prizes for lucky numbers. Prizes donated by John Hall and Ern Ashley.

2 pm General Assembly and introductions.

2.30 pm Test emission of 18 watter.

3 pm to 6 pm: G. Challender (VK2ZS) Remembrance Trophy Contest. The trophy and cup valued at £20 is for annual competition at conventions.

First Prize: A replica of the cup donated by W.I.A., NSW Div., and £2 donated by Dr. Hewitt.

2nd Prize: Scope Soldering Iron donated by H. Powell.

Conditions for the contest are as follows: Competitors will endeavor to contact as many stations as possible in the period on 7Mc. Operation must be conducted within eight miles radius of Urunga. No power limit but the results will be judged on a Power input handicap. Power must not be drawn from the town power supply.

Saturday Evening: Pictures, cards, dancing, fishing.

A fishing contest will commence at 6 pm and terminate at 9 am on Monday.

Sunday, March 25th:—

9.30 am: World's Championship Yabbi Catching—Cec Hardman VK2KR will defend his title. Launch parties will leave at the above time and after the competition the trip will be continued until noon.

1.45 pm:—144 Mc. Hidden Transmitter Competition. Silver Cup valued at £15 donated by Gleeson Bros., is for annual competition.

First Prize:—Replica of the cup donated by W.I.A. NSW Division and £5 donated by Norm Moody.

Second Prize:—£1/1/- donated by Hart Wall.

The transmitter will be located within three miles of Urunga, the rest is up to you!

2.30 pm: Ladies will assemble at the "Do Me" shack for special competitions and to meet Mr. and Mrs. Percy Sara and the Bellingen Quads at 4.30 pm.

3 to 4 pm:—"Urunga Scramble" competition. You may use any equipment, any band, any power to work the most stations within the hour.

Cup for annual competition.

First Prize:—Replica donated by the W.I.A. NSW Division and 500 QSL cards donated by Ern Ashley.

2nd Prize:—807's.

7.30 pm:—Assembly at the School of Arts for an official welcome by the Bellingen Shire President Mr. Mark Goldstein and presentation of prizes besides a film show by Ted Hamey.

Monday, March 26th:—Final session and review.

Accommodation at the hotel is reserved for amateurs who are bringing their wives, but shacks are available for sleeping for others. Crieff Retallick VK2XO will supply any further information—book early and help the committee.

If you do go don't forget some 144 and 7Mc. equipment so you can join in all the competitions.

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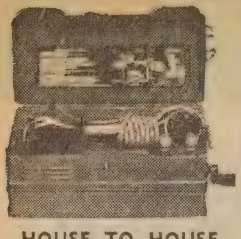
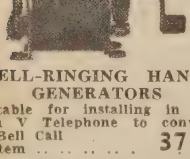


HOUSE TO HOUSE TELEPHONES

These British Army Field Telephones are now doing invaluable work on the home front, from house to shed or from neighbor to neighbor or any form of inter-office communication. No batteries are required as a voice-powered handset is incorporated. They are also bell ringing. Price per set of two phones £8/15/-

R.A.A.F. ASTRONOMICAL INSTRUMENT can be utilised to measure horizontal and vertical angles such as those encountered in road making and irrigation work. It is fitted with scales calibrated in degrees, two levels and adjustable turntable mountings £2/15/-

Postage and Packing: Vic., 2/9; N.S.W., S.A., Tas., 4/6; Qld., W.A., N.T., 6/3.



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Suitable for installing in the Don V Telephone to convert to Bell Call System 37/6

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HYGRO-METER

For Temperature and Humidity readings as supplied to the Air Force. No Home, Farm, Factory, or Dairy should be without one of these. Price 19/6

CHART SUPPLIED. Postage and Packing, 2/6.

8-day clocks by the famous Waltham Clock Co., of America. Ex-U.S. Navy, 24 hour luminous dial, showing date, hours, minutes, seconds. Size 3¼in. Worth £25.

£9/10/-

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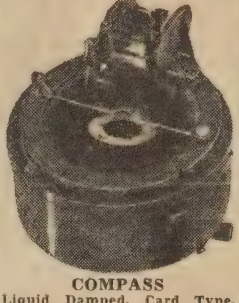

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Liquid Damped, Card Type. 6½" dia. x 3¼" deep, fitted with large viewing prism, ideal for small craft, etc., for normal navigation and also taking bearings. Each £6/10/-

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METAL DETECTOR

The wartime mine-dectector is now doing a very useful peacetime job, and has proved invaluable to PLUMBERS, GAS FITTERS and MUNICIPAL COUNCILS. It originally worked on the principle of finding the metal casing of mines. Metal pipes and cables can be traced quite easily in the ground. This saves the laborious, costly and time-wasting digging of "search holes," when the underground path of the pipes is uncertain, as it frequently is. The units contain two interchangeable sweep coils, one large and one small, and pack complete with valves and headphones. Packed in stout wooden transit case, 10" x 12" x 4' 6". Total weight, 80lbs. PRICE, each £8/10/-

TANK WHIP AERIALS

Two four-foot sections, ideal for car aerials, or fishing rods. Each 15/-

R.A.A.F. NAVIGATORS' PLOTTING BOARDS

18" x 18", complete with Pantograph 17/6

ELECTRIC MOTOR

50 volt, 50 cycle. Can be rewound to 1/10th H.P. 230-volt A.C. Diameter of shaft, 3/8in.,, self-aligning ball races. 35/-

Postage and Packing: Vic., 2/9; N.S.W., S.A., 5/-; Qld., N.T., 7/3

CHART PLOTTING BOARD ARMS

Suitable for Draftsmen, etc. Complete with Hinged Runner. Length of Arm Extended, 24in. Brand New, 35/-. 35/-

Postage and Packing, 5/-.

WE SHALL BE GLAD TO GIVE QUOTES ON QUANTITIES OF 50 AND 100.

SPECIAL SLOW SPEED MOTOR

24-volt, approx. 1/6th H.P., reversible motor, fitted with 5000 to 1 reduction gear and magnetic brake. £2/17/6

Postage and Packing: Vic., 2/9; N.S.W., S.A., 5/-; Qld., N.T., 7/3

BLOWER MOTORS

80-volts D.C. with laminated field. Approx. 1/10 H.P. 45/-

Postage and Packing: Vic., 2/-; N.S.W., S.A., 3/6; Qld., N.T., 5/-

COMBINED MOTOR

Combined 24-volt motor and High Pressure Hydraulic Pump, 600lbs./square inch. £3/15/-

ELECTRIC MOTORS

24-volt, A.C., D.C., 1/40 H.P. with laminated field. 50/-

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All generators checked and tested before despatch.

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24 Volt, 1500 Watt	15	0	
12 Volt, 750 Watt	12	10	
12 Volt, 500 Watt	10	10	

The 24-volt, 1500-watt Generator can be used for 32-volt system without any alteration.

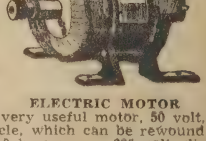
24 Volt Regulator and Cutout

Made by Bendix Aviation Corporation. Suitable for use with above generators in home lighting plants. £3/10/-

COURSE AND SPEED CALCULATORS

A very useful instrument for the Air Trainee. Marked with a Port and Starboard drift indicator, contained in wooden case 11in. x 6in. x 2¼in. PRICE, each 12/6

Postage and Packing: Vic., 2/-; N.S.W., S.A., Tas., 2/9; Qld., W.A., N.T., 3/9.



ELECTRIC MOTOR

A very useful motor, 50 volt, 50 cycle, which can be rewound to 1/10 horsepower 230 volt, diameter of shaft 5/8in., self-aligning ball races, ideal for handymen and hobbyists. Only 35/- each.

Postage and Packing: Vic., 3/6; N.S.W., S.A., Tas., 8/-; Qld., N.T., 8/9.

SELSYN MOTORS

50 Volt, 50 Cycle, ideal for use with Rotating Beam Aerials 30/-

Postage and Packing: Vic., 2/-; N.S.W., Tas., S.A., 3/6; Qld., N.T., W.A. 5/-.

DX AND PERSONAL

THE original VK1 gang that were on Heard and Macquarie Islands have performed some good work, in sending out the QSL's that help the gang along in the DXCC business. It must be quite a struggle to catch up on the log book—it was much appreciated by all recipients.

Ron Sterrett VK1AD's Ron Oah VK1VU and Art Burton VK1FE sent out hundreds of QSL cards. VK1PG ex-VK2PG who is on from Heard Island at the moment, will have his work cut out when he arrives back, judging from the large collection of choice DX cards awaiting him at the NSW W.I.A. QSL Bureau.

The Hunter Valley Emergency Net was again alerted during the Hunter Valley floods mid-January. Regular schedules were kept from Friday till Sunday when the danger point was passed.

The river height at Maitland reached record levels but fortunately dropped rapidly. Although many people were driven from their homes normal communication services were not interrupted. The net operated under the guidance of John Traill VK2XQ emergency officer for the area. Members of the net active were VK2ANU 2VU, 2DG, TY, 2AKP and 2AHA.

The NSW Division of the W.I.A. is in receipt of a letter from Superintendent Clifford of the NSW Police Department who is a member of the Flood Relief Committee thanking amateurs generally for the assistance rendered during the various floods of recent months.

A suggestion by G5JU that our present T code be varied to suit modern conditions has received some publicity in Great Britain. Some of the more cynical of our fraternity might suggest, that T1 to T8 could be eliminated for the CW gang and the S code be varied for the Telephony gang to cover the number of DB over S9 only.

G5JU explains that the section of the T code from T1 to T7 is rarely used, and that it could be rearranged to cover:—

1. A.C. ripple. 2. Frequency variation including drift. 3 Key clicks. His suggested code is as follows:—

TO Conveys that the note is extremely poor and insinuates that steps should be taken immediately to improve it.

T1. A.C. ripple present.
T2. Noticeable key clicks.
T3. Slight, steady drift.
T4. Serious steady drift.
T5. Random drift.
T6. Slight chirp.
T7. Serious chirp (the all too common "Twa-Twit" signal).
T8. Signal of reasonably good qulaity, but lacking that almost indefinable T9 quality.
T9. Reserved for the really superb quality signal, free from all vices.

Perhaps the above is not everybody's idea of an amended T code but most will agree, that the T code could be varied to make it more effective.

A.O.C.P. CLASS

The Victorian Division A.O.C.P. Class will commence on Thursday, 12th April, 1951. Lectures are held on Monday and Thursday evenings from 8 to 10 p.m. Persons desirous of being enrolled should communicate with the Secretary, W.I.A., Victoria Division, 191 Queen Street, Melbourne (Phone FJ6997, from 10 a.m. to 4 p.m.), or the Class Manager on either of the above evenings.

OFF THE RECORD — NEWS & REVIEWS

By JOHN MOYLE

The records of 'Corroboree' by John Antill recently made by HMV, are now available as the most interesting release of the month. From a musical and technical angle, they are probably the most Australian records ever issued. The orchestra and composer are Australian, and the music could not have originated in any other country.

NATIONAL character in music isn't always easy to define. Music has this character if it stimulated our minds in reference, consciously or otherwise, to past experiences of our country and its life.

The obvious method of doing this is the inclusion of easily recognised or symbolical sounds, or perhaps national tunes. This will spot the music geographically, but that's about all.

But the mental stimulation I mean must be brought about and sustained by much more subtle devices — so subtle, indeed, that their presence almost defies detection.

In John Antill's music, we can find examples of strong local color not out of place in ballet music. The clicking of the trora sticks, for instance, is a motif heard through the music, and with its suggestions of frogs croaking and other bush noises, sets an unmistakably programme background. Oboes and celestes are used to portray bird totems, a vibraphone the fish totem, and finally, the bull roarers heighten the excitement of the finale.

These are only a few examples of the imitation of bush and aboriginal sounds associated with the corroboree, all of which are handled with great restraint and skill. These things are not merely included in the score as orchestral tricks — they are woven into the texture of the music in such a way that they become the music itself.

Although such stress is placed upon the musical atmosphere, it supports a number of themes which tie it together, and give direction to its course. These are not so obvious nor programmatic, but they have a flavor which we feel is at one with the moving background of sound, and have their germs in no other country.

CORROBOREE SPIRIT

Most striking is the suggestion which Antill has caught so well of the mystery of the corroboree — a hint of another world to which most corroborees refer freely — a world of spirits and superstition and mystery. For a corroboree is more than a mere dance and a performance. It is also a ritual, not to be taken lightly, something which expresses human emotion too remote and fundamental to be understood, and therefore spoken.

So that in saying and agreeing with the conductor, Eugene Goossens, that Antill's is probably the first important composition to be really Australian, I am only recognising what I have heard in the music itself. It is a supremely skilful and competent work by a man with great imagination and coherent emotional power, and it cannot fail to become probably the first classic in Australia's musical repertoire.

Music of this nature and theme had to be written sooner or later. I think Antill has done it in such a manner as to kill competition—perhaps fortunately — from less gifted quarters. If that sounds malicious it isn't meant to be—only sorrowful.

FINE PERFORMANCE

As to the performance, this cannot of course be estimated on a comparative basis. Whether other orchestras would make a better job of it probably only the conductor would know, but I can only say that the ABC Sydney Symphony Orchestra exhibits a most satisfying standard. This must be extremely difficult music to play, and to conduct. In unsympathetic hands it could easily become a meaningless shambles.

Into the score Antill has written a

wide range of instruments which, as I have said, are not there as passengers. Moreover there are many passages where the instrumental color depends on special effects from almost every section of the orchestra. This makes the task hard enough for straight performance, but even harder for a recording. Only the recording engineer can know how easily a sudden blast can be converted into a ridiculous burp through the microphone, or a balance requiring careful adjustment be completely upset into something quite different.

I think in this respect, HMV are to be commended with everyone else. This is the first time they have been called upon to handle a big orchestra of about 80 players, which means that they were working without the benefit of long experience with recording chambers and techniques enjoyed by overseas recorders. They faced a big task in such a complex score.

RECORDING HALL

The Ashfield town hall where the recording was made was selected as being the most suitable hall of those available, and proved quite good for the purpose. Special acoustic treatment was required to control reverberation, which included hanging of absorbent material and curtains in the hall itself.

One hazard was the possibility of traffic noises being included with the recording, but those which did get through have made no apparent impression on the discs as released.

Several elaborate microphone setups were used for the recording. One of these employed a single high quality condenser microphone with which the HMV engineers have done some very fine work and another used a group of dynamic microphones strategically placed with respect to the orchestra.

TAPE USED

The recordings were made on tape, two simultaneously with machines in the hall, and a third via landline at the EMI studios at Homebush. As each "side" was recorded and checked more than once during the recording period, quite a few prospective pressings were available for selection.

The tape recording was then transferred to the normal waxes for treatment through the normal process of making the records themselves.

The actual recordings issued were those selected after consultations between the conductor, composer and recording engineers as being the most successful.

As to this success, I think the release compares quite favorably with other similar types from overseas, and has a particularly good dynamic range. In fact, I'm inclined to think the quieter passages have been if anything under-recorded. They do serve to heighten the weight of the terrific climax, but for my taste, they are a little too close to the surface noise level.

The final side tends to become a little muddy towards the end, where the opposite has happened, and the grooves extended to their limit. However there has rarely been a record release which cannot be criticised on some point or other, and these remarks are made without prejudice to the extremely good work represented as a whole.

I recommend these discs to everyone. If on first hearing, you find the music a bit of a shock, you'll like it, sooner or later.

HOME RECORDING

Preliminary work on the design of a home recording unit is now virtually complete, and in the very near future we hope to describe the recorder in the technical pages of Radio and Hobbies.

All kinds of recording work have been done with it, and the results have been most gratifying.

One thing, as expected, has been pretty well demonstrated, and that is that micro-groove recording has just about supplanted any other type for general use.

When this type of recording was first mooted we did have a number of reservations as to whether the extremely fine tolerances could be met successfully without more elaborate equipment. However, for three months, on and off, dozens of records have been made in this way, and personally I wouln't consider using any other except for specific occasions.

One gratifying point is that the same recording stylus has been used throughout and it is still cutting perfectly good records. Despite its fine point it has not shown any signs of being particularly fragile, although I have been careful to avoid cutting through to the metal base, or the more obvious sin of dropping it on the record. It has, I think, been through to the aluminium on about two occasions, but only just. Now that it is nicely set up there seems no reason to change its setting from one week to another.

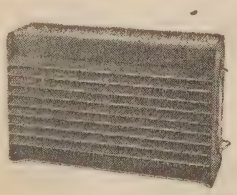
RADIO VALVES

We have large stocks of all types of Radio Valves. Below are listed some of the "hard-to-get" types we have.

VCR 97	6" Cathode Ray Tube	38/6
5BP1	5" Cathode Ray Tube	37/6
2X2	Rectifier for Oscilloscope	15/6
884	Gas Triode for Oscilloscope	28/-
866JR	Heavy Duty Rectifier	24/-
6J6	Twin Triode	25/-
6AG7	HF Pentode	27/6
6AC7-1852	Television Amplifier Pentode	25/9
6F6 metal	Output Pentode	18/9
6F7	Triode, Pentode	23/3
6L7	Mixer	21/3
12A6	Beam Power Amplifier	19/-
12C8	Duo Diode Pentode	21/9
12K8	Converter	21/9
12K7GT	RF Pentode	18/-
12SK7	RF Pentode	18/-
12SR7	Duo-diode triode	20/-
12SF7	Diode Pentode	19/9
12SG7	RF Pentode	19/3
2525	Rectifier	17/-
25A6 GT/G.	Power Output Pentode	16/6
3525	Rectifier	14/-
1629	Electron Ray Tube	10/-
CC1	Triode .2 amp. fil.	15/-
CF1	RF Pentode .2 amp. fil	15/-
CL4	Output Pentode .2 amp. fil.	15/-
CY1	Rectifier .2 amp. fil	15/-
C1	Barretter .2 amp. fil.	15/3
CK1	Mixer .2 amp. fil.	17/6
EF50	HF Pentode	15/-
U31	Rectifier 25 volt .3 amp. filament	7/6
1941	Barretter .3 amp.	13/9
6J5GT	Triode	16/-
VR21	2 Volt Battery Triode	2/6
VR18	2 Volt Battery Triode	2/6
VR22	2 Volt Battery output triode	2/6
7193	High Frequency Triode	10/-

PLEASE NOTE: Trade Prices available on all standard type valves to genuine radio dealers, etc.

Sockets for EF50 Valve. Low loss type for HF work 3/-
Power Transformer to give 2000 volts for use with 5BP1 or VCR97 Valves 10/-



EXTENSION SPEAKERS

KINGSLEY EXTENSION SPEAKERS, as illustrated. Finished in Gold, cream, brown, etc. Complete with Rola 6" Speaker, £2/15/6.

Extension speaker box only, 15/6.

PLEASE NOTE—ALL PARCELS WILL BE SENT REGISTERED POST UNLESS OTHERWISE STATED. POSTAGE OR FREIGHT MUST BE INCLUDED WITH ORDER.

RESISTORS

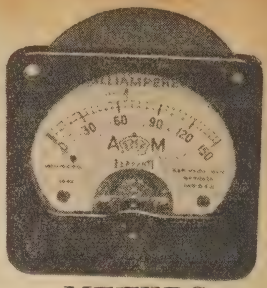
BRITISH NAVY RESISTORS, Heavy Duty. Wire wound as illustrated:—

Resistance	Wattage	Price
25	20	2/6
250	20	2/6
350	25	2/6
500	27	2/6
500	55	4/-
1000	25	2/6
1000	85	5/-
1000	120	5/-
1500	25	2/6
2000	20	2/6
2000	25	2/6
2500	85	5/-
4000	20	2/6
5000	55	4/-
5000	20	2/6
7000 Tapped at 3000.	55	4/-
10,000	10	2/6
10,000	55	4/-
12,500	20	2/6
15,000	20	2/6
24,000	55	4/-
100,000	120	5/-

CHIEFTAIN MULTIMETER

The ideal pocket size meter for measuring voltages of electrical circuits and checking continuity of circuits, etc. Volt Scales 0-15, 0-150, 0-300, 0-600, D.C. Ohms Scale 0-50,000. The cheapest and smallest on the market. Complete with prods and battery, can be carried in your coat pocket with ease.

PRICE, £3/9/6.



METERS

We have the following meters in stock. They are mostly brand new and if not, they are in excellent condition.

Type of Meter	Size	Type of Meter	Price
0-1 MA. D.C.	2in scale	Square	32/6
0-20, 0-200 DC Volts.	„ „	Round	17/6
0-.5 amps. R.F.	„ „	Round	22/6
0-40 volts. D.C.	„ „	Square	19/6
0-3 amps. R.F.	„ „	Round	22/6
0-2.5 amps. R.F.	„ „	Square	22/6
0-50 MA. D.C.	„ „	Square	22/6
0-100 volts. A.C.	„ „	Square	39/6
0-20 volts. D.C.	„ „	Square	19/6

Please note the 0-100 volt AC meter is an excellent buy as it has a 1 MA dry metal rectifier valued at 35/- built into each meter.

WIRE

Outdoor Aerial Wire. 7 strands of steel and 1 of copper, insulated and weatherproofed. 100ft lengths. 5/- each.
Special price for large quantities.
Twin Shielded Wire.
Suitable for radio work. Two rubber insulated stranded cores of different colors, enclosed in woven tinned copper metal sheath. Easily worth 2/6 yard, our price 1/3 yard.

VIBRATORS

Ex-Disposals in new condition, but shop-soiled. 12 volt, 6-pin Ferrocart. Non-Synchronous. Usual price 27/6. Our price 7/6
6 Volt 7-pin Mallory Synchronous Type 552 . . . . . 7/6
6 Volt 7-pin Oak Split Reed Type. V.5. 211 . . . . . 12/6

M/S MOTOR SPARES LTD.

547 ELIZABETH STREET, MELBOURNE

PRODUCING THE FORGOTTEN ELEMENTS

(Continued from Page 5)

stalled a battery of 24 resin columns, eight feet tall and four inches in diameter—and made history by accomplishing the feat. Watching the precious liquids trickle from glistening glass columns into collecting bottles the size of water jugs, a visitor to the pilot plant hardly realises the miracle taking place in the tubes.

Into the top of a tube goes a mixture of rare-earth elements—redissolved in acid after acid extraction from the ore and crude preliminary chemical separation into two main groups, light and heavy. Like flies to flypaper, ions—individual charged atoms of rare earths—stick to the resin at the upper end of the tube. Thus they are strained —"adsorbed" is the technical word —from the acid, which is then removed by washing.

Now a dilute solution of citric acid and ammonium citrate is poured down the column. Rinsed from the resin, or "eluted" if one prefers the scientific term, a typical rare-earth ion starts down the tube. Almost at once it sticks to the resin again. This progress repeats itself, over and over, all the way to the tube's bottom. Eventually all the rare-earth particles reach bottom. But those of the element of highest atomic number get there first; those of the next highest number, next, and so on. Switch the liquid output from one collecting bottle to another, at the right time intervals, and nearly every bottleful or "fraction" will contain a single purified rare-earth element. A few fractions in which elements overlap are re-treated; and purified fractions, if still higher purity is wanted, may also be run through a column again. The solutions yield oxalates, by precipitation with oxalic acid. Then heat treatment converts these to the rare-earth oxides—the form desired for many experiments and from which other compounds may readily be prepared. Purity runs around 99.9 per cent.

By "smelting" rare-earth oxides when enough are on hand, the American chemists produce miniature ingots of the pure metals—tiny one-twentieth of an ounce cylinders of silvery praseodymium and neodymium metals, sealed against corroding air in helium-filled glass vials, and comparatively massive 1.3-pound chunks of cerium and lanthanum metals. Their weight compares with iron, their softness with calcium; like the latter, they react with water, liberating hydrogen.

If new uses require pure metals, the high production costs—which the experimenters hope to reduce—may not be commercially prohibitive. Like radium in watch dials, a little may go a long way. Or like platinum in chemical crucibles, advantages may outweigh cost. But it is primarily for research that scientists prize the newly available pure preparations. By arrangement, Popular Science.

LEARN WHILE YOU MAKE IT

(Continued from Page 29)

fundamental principles from simple sets of this nature. For a start it will help if the builder is able to appreciate the purpose of each of the components used. As progress is made he will be in a better position to understand why they do what they do.

SELECTIVITY

The first requirement of any set is that it shall be able to respond only to those signals which we wish to hear, and reject all others. The better able a set is to select the required station, the more "selective" it is said to be, while the adjustment of a set to receive a station is called "tuning."

In the crystal set, as well as in most other types, the variable condenser and the coil provide the means of selecting stations. The only difference being that, whereas in this set we use only one such tuned circuit, in a larger set there would be several, each one adding to the selectivity.

The next requirement, and one common to all receivers, is that of detection, or the separation of the audible signals from the radio frequency carrier. There are several ways in which this is achieved, and the crystal detector, in its many forms, provides one of them.

Finally we have to convert the electric impulses representing the sounds transmitted, back into real sound. This is also common to all types of receivers, and is achieved in much the same way in all of them. In the case of the crystal set the headphones perform this function, while in larger sets the job is done by the loudspeaker.

HANGING YOUR SKY WIRE

(Continued from Page 39)

clothes-line post or fence will often be a great help in pulling up the mast. We have assumed little help from these, as in fact there was none in our case. Some people use a jury mast or "gin pole" to help with extra leverage, but these shouldn't be necessary unless the mast is longer and heavier than our 50-footers.

Total time to get both masts into the air and all guys lashed into position was exactly one hour in our case. We cannot emphasise too strongly the necessity for complete preparation beforehand. See that the guys are long enough to handle the mast during its erection. Rope can be used to lengthen them if necessary for the process, and always have some rope or extra wire handy in case an extension should be required in a hurry during the job.

ANCHORING THE GUYS

Guy anchorage needs some thought. Strong fencing is generally suitable if the guys are looped around the posts near the bottom, but make sure the fences are firm, particularly for the guys which take the aerial pull and that of prevailing winds. If you must sink posts, see that they are deep, have a crosspiece near the bottom so they won't pull out, and maybe another near the top to stop them working loose in the ground.

It is difficult to give a reliable figure for the correct distance to anchor guy wires from the bottom of the mast.

The closer these are to the mast, the greater will be the strain upon them and their anchorage.

Our 50ft masts were anchored approximately 15ft from the base, and this distance appears to be quite adequate. We would say that 12ft would be as close as desirable, calling for firm attachment to withstand high winds.

If the guys are rather close to the mast, always try to run the aerial "back-stay" further out than the others. With the pull of the aerial, it has the greatest strain.

A COURSE IN TELEVISION

(Continued from Page 67)

During the periods of zero plate current the capacitor charges through C, but it is immediately discharged by the following burst of plate current. Therefore the plate voltage curve follows the sawtooth pattern indicated by figure 5.

The charging current into C is independent of the grid-circuit discharge, since the plate current remains at zero. Therefore, by suitable selection of R and C in the plate circuit, the charging cycle can be made equal to any desired proportion of their natural time constant.

The grid circuit controls only the period of the plate circuit oscillation, not the amplitude or the linearity.

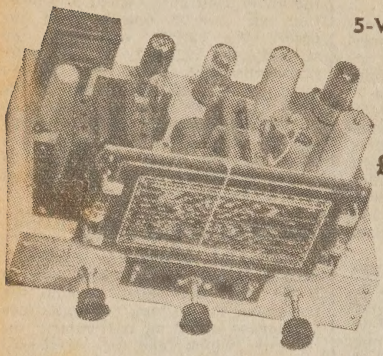
Normal practice is to make the blocking frequency just slightly lower than the required line or frame frequency, using the synch. pulses to trigger the start of each oscillatory cycle. For this purpose R2 is commonly brought out to an accessible position and marked "line hold" or "frame hold." The correct adjustment is when the oscillator just holds positively in step with the transmitted synch. pulses.

Maxwell's Radio

6 Guaranteed Kit Sets

IMMEDIATE MAIL ORDER SERVICE ANYWHERE

Radio & Hobbies No. 1 Kit Set



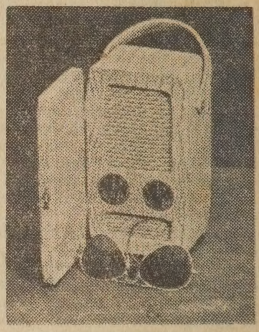
5-Valve B/C Superhet complete with 8" Speaker

£14/10/-

This simple to construct set was fully described in Radio and Hobbies. July issue.

Kit Set No. 2

4 Valve A.C. and Battery Personal Portable

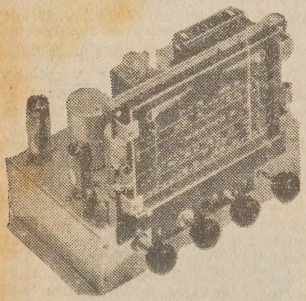


4 valve AC and BATTERY personal portable with built in AC Power Unit. Housed in attractive leatherette cabinet actual size 10" x 5" x 5".

Complete in every detail including batteries.

£19/15/-

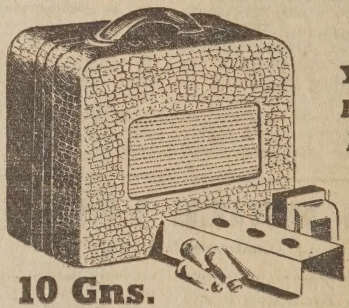
Kit Set No. 3 The NEW BABY Gram



A miniature AC radio receiver. Chassis fitted with pick-up Terminals. Ideal for a portable outfit. Fully described in Radio and Hobbies, January 1951.

£13/19/6

Kit Set No. 4



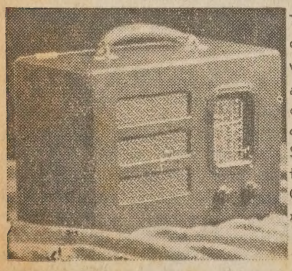
Build it Yourself! Ideal for Pick-ups

3 Valve AMPLIFIER KIT-SETS

10 Gns.

Complete with valves 6SJ7,, 6V6GT, 6X5GT, 3½ Watt out-put, Rola Speaker. Every necessary component for the job, including easy to follow circuit. CH. Size 11" x 3" x 1¾". Cabinet £2 extra.

No. 5 STANDARD SIZE 5 VALVE SENIOR PORTABLE KIT SET

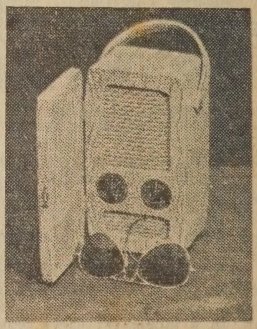


This Radio and Hobbies designed, 5 Valve portable with R.F. STAGE is really a splendid performer and our special price includes cabinet, 6" ROLA SPEAKER. Batteries etc. to the last nut and bolt. O/All size 12½" x 6½" x 8¼".

18 Gns.

Kit Set No. 6 CARRY SET

Personal Portable Kit



CARRY SET 4 Valve Personal Portable O/All size 8" x 4" x 4½" as featured in Radio and Hobbies October 1949 issue. Easy to construct and splendid performer. Complete in every detail, including batteries.

£12/12/-

MAXWELL'S RADIO

48 ELIZABETH ST., MELBOURNE. CENT. 4913.— Add Postage to all Amounts

ANSWERS TO CORRESPONDENTS

M. N. (Wayville, S.A.) acknowledges some points made recently in the "Argument" series.

A: Many thanks to you also for your contributions. The feature provides an interesting method of airing ideas and grievances that would otherwise never be expressed.

J. H. G. (Mentone Vic.) Sends two years subscription, and states his appreciation of R & H. He is particularly interested in the new series on photography, and makes some suggestions for future articles of this nature.

A: Your subscription has been forwarded to the appropriate department, J. H. G., and many thanks for your kind remarks. The suggestions regarding photography have been noted, and it is hoped that ultimately most of these subjects will be covered.

H. M. (Christchurch N.Z.) has been having some trouble with spurious oscillations in 6V6 valves, but has recently discovered a cure. He also asks how to calculate shunts for a disposals meter which he has on hand.

A: The cure you mention is quite normal, H. M., and has been mentioned in R & H several times. It is sometimes difficult to know how often to repeat these items so as to keep the newcomers well informed without boring our regular readers. Several R & H circuits have these stoppers fitted as a standard precaution, particularly when the high gain 807 valves are used. Another scheme which is popular with the continental makes of receivers is to use a screen stopper consisting of approximately 100 ohms in series with the screen supply to the power valve, and connected right at the socket.

The value of shunts required for your meter may be calculated from the following simple formula. Shunt value equals meter resistance, divided by the required multiplying factor minus one. For example the 10 mA range would be calculated as follows. Meter resistance equals 500 ohms, which is divided by the required factor (20) minus one which is 19. 500 divided by 19 equals 26.31 ohms. Many thanks for all your good wishes for the new year.

R.L.R. (St. Peters, NSW) sends in his subscription and passes favorable comment upon the appearance of the series of articles on photography in the magazine.

A. Your subscription has been dealt with by the subscription department, R. L. R., and by now you should have received their official receipt. We are pleased to note your interest in the articles on photography. Further articles on this wide subject are contemplated and we trust that the field covered will meet with your approval.

J.H.McK. (Toorak, Vic.) tells us that he was pleased to note the commencement of the series of articles on photography in the magazine.

A: Pleased to note your interest in those articles, J. H. McK. Your request regarding an article on the tinting of photographs falls outside the scope which we originally intended to cover. Actually, it moves into the field of art. However we will bear the idea in mind.

P.G. (Wahroonga, NSW) also writes in appreciation of the photographic articles.

A. We are very glad you find this series so interesting and we hope to make use of some of the suggestions contained in your letter. We do not know whether it will be possible to cover all the subjects you mention particularly some of the constructional articles, which may prove to be too expensive for the average amateur.

J.R. Murwillumbah, NSW) makes some requests regarding the new tone control unit.

A. The 6N7 is not a direct replacement for the 6SN7 having a higher amplification factor and higher plate resistance. However, if you have one of these valves on hand it should be worth trying. It may be advisable to increase the plate lead resistors to 100,000 ohms but the values in the actual frequency division circuit would not be affected. The value of the condenser in the treble control circuit is 30 pf.

W.M. (Mackay) wants to know where he can obtain constructional details of wooden toys, &c.

A. We suggest you contact such booksellers as Angus and Robertson, of Castlereagh Street, Sydney, or the New South Wales Bookstall, of Castlereagh Street, Sydney and explain your requirements.

H.L.H. (Ipswich, Qld) wants some further information on the micro wave lens mentioned in Radio and Hobbies for December, 1950.

A. We regret that we have no further information on this subject as this article came to us from one of our overseas agencies. You may possibly obtain some further information from the CSIRO, National Standard Laboratory, University Grounds, City Road, Chippendale, Sydney, NSW.

C.H.C. (Paddington, NSW) has been conducting some experiments in push button tuning and has now reached the stage where he is considering protecting his ideas by patents. He is anxious to know what work has been done along these lines before proceeding further.

YOUR QUERY?

1. Queries will be answered in rotation through the columns of our magazine if not accompanied by a fee for a postal reply.
2. Queries, neatly and concisely set out, will be answered by mail as quickly as possible if accompanied by 1/- in postal notes or postage stamps. Endorse envelope "Query."
3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."
4. Blueprints of exact size chassis layouts with all essential holes, and cutouts will be supplied if available for 2/6. Endorse envelope "Blueprint."

Address your letters to the Technical Editor, "Radio & Hobbies," Box 2728C GPO, Sydney.

A. The subject of push button tuning is a fairly involved one and a very great variety of schemes have been evolved and patented both in this country and overseas. This means that your particular scheme would have to be a rather radical departure from present ideas if it was not to conflict with them in one respect or another. In this case a patent would only be worthwhile, or indeed possible, if your device was shown to offer considerable improvement on existing devices of a similar nature. The approach would seem to be to prepare all plans and specifications of your idea, as far as this is possible at this stage of your experiments, and then to enlist the services of a patent attorney. His job will be to approach the patent authorities and make a search of, and investigate, those patents of a similar nature to your own idea. On the nature of his report, you should be able to make a decision as to whether your scheme is worth protecting. We believe that where there is the chance that the search may take some time, it is possible to obtain a provisional patent for a period of 12 months, which will provide protection until such time as you are able to decide whether the scheme is worth pursuing or not. It must be realised that all the foregoing procedure will call for some financial outlay, and it will be for you to decide whether the prospects for your idea as it stands, will justify this outlay. In a similar manner, the actual value of the idea from a commercial point of view would need to be considered before the cost of a patent could be justified. After all, there is no point in protecting the idea unless there is a reasonable chance of a financial return in the form of royalties, &c. We trust that this information will be of some help to you, and wish you the best of luck with your idea.

G.D. (West Hobart, Tasmania) is anxious to obtain a relay from an SCR-522A communications set, similar to that mentioned in one of our recent articles on radio control. He lists the various disposal stores which he has already tried without success.

A. We regret that the list you have submitted seems fairly conclusive, and we are unable to advise where else you might try. However, some of the smaller disposals stores do not advertise and it is possible that some of our readers may be able to advise you in this regard. Any reader who is able to help, may care to write direct to: Mr. G. Dunne, 47 Poets Road West Hobart, Tasmania.

M.F. (Rockdale, NSW) requires a circuit using 1.4 volt valves to operate from either a six volt car or motor cycle battery.

A. The circuit which comes nearest to your requirements is the Economy Five, which was described in R & H for November, 1948. Circuit diagram, parts lists and photographs are available from this office through our postal service, price 1/6. It must be pointed out that this type of set is not recommended for use on a motor cycle, or even in a car, as the vibration would most likely prove excessive for the type of valves used. Current consumption is slightly less than three-quarters of an amp.

J.W.F. (Aspendale, Vic.) recently built the All-Wave AC Ten, and obtained good results on the broadcast band, but had trouble with coils on the shortwave bands. He has since rebuilt the set and is having better results.

A. Your results do not coincide with the performance put up by the original set which was good enough to indicate that very little need be sacrificed in order to have the benefit of the broadcast band. It would seem that the main fault would have been found in the coils and, no doubt, a little work on them would have produced results similar to the original. However, your present set-up seems to be working quite well and it certainly represents an interesting combination of ideas. We have noted your ideas about coil data, &c. and we may be able to incorporate these in future articles.

R.M. (North Brighton, Vic.) sends details of a home-made pickup for possible publication in the "Reader Built It" column.

A. Many thanks for the details, R.M., and we may be able to make use of the article in the near future. In the meantime you may care to forward any additional information such as response curves, &c., which you may have.

H.Z. (Christchurch, NZ) requests some additional information on the shortwave converter described in the 1950 Shortwave Handbook.

A. This converter was originally described in Radio And Hobbies for January 1948, but we regret that copies of this issue are no longer available. However, you may be able to find someone with a copy which you can borrow or alternatively you may care to insert an advertisement in our "Wanted To Buy" column.

A.N. (Yarram, Vic.) writes in appreciation of the recent photographic articles and makes some suggestions as to how this series might continue.

A. Many thanks for your letter, A.N., and the suggestions for the photographic articles have been noted, and in due course we hope to prepare some along the lines you suggest.

NOBODY KNOWS YOUR NOSE

(Continued from Page 19)

slow diffusion upwards. This takes a little time.

When therefore it is desirable to avoid smelling some objectionable odour it will be found that one automatically breathes gently through the nose or mouth. This serves to avoid creating a turbulence within the nasal passage thus serving to exclude a large proportion of the objectionable odour.

In animals the odour sense is, of course, very acute. For instance, about one third of the brain of an opossum is given to the olfactory sense.

With all our advances in things scientific we seem not much nearer the solution to the problem of olfaction.

Since beginning this article a new revolutionary theory has been brought to my attention.

At Yale University a Dr. Beck and Dr. Miles have collected some evidence which seems to indicate that odour perception has something to do with infra red rays emitted by the receptor cells.

The investigators state that olfaction results when the radiation of heat from an organism's receptors is accelerated. This brings about an electro magnetic reaction, final causing the brain to decode the i pulse into smell. Full details are n available as yet.

MOTIVE FORCE

(Continued from Page 11)

a plume of white condensing stea streaming over it from the stack.

The steam seems suddenly to e at the rear of the train, and I ho you have thought of a good reas for this vital phenomenon. It of course, because the slight vacuu behind the train causes the moistu particles again to evaporate in steam before being lost.

It used often to be stated, no that we are moving so fast, th soldiers and ordinary mortals som times had a nasty shock when touch ing the body of a car that had be standing for a short time in a dese wind.

This is nothing to do with H leaks, ignition apparatus, neo operated lights, or any other clev affairs. It is the old case of sa friction causing a charge upon th highly-polished and fairly well i sulated panels of a car.

Wanted to Buy, Sell or Exchange

FOR SALE: Goodman's Audiom 60, 40-10,000 cps., 15w, brand new. Offers. **Thompson, 121 Forest Road, Arncliffe.**

FOR SALE: Eddystone 640, condition as new. **K. Echberg, 17 Venn Street, Peppermint Grove, W.A.**

FOR SALE: Australian Sound Systems amplifier with (1) speaker, (1) microphone and homemade stand and built-in tuner. Cost £45. Recently overhauled, new output trans. Will accept £30 or offer. Must sell. **FU3019, after 6 pm any night.**

FOR SALE: Dynamike Moving Coil Microphone. High Impedance, built-in Transformer. 9ft rubber-sheathed-cord. Quick sale, £5/10/-. **Warburton, 14 Herbert St., Manly. XU4857.**

RC.A.: BC 348-0, perf. order, with 230v pack and 8" spkr. in separate cabinet, £35. Brand new resistance Bridge and Galvo, £4. 3½" uncal. 0-10 mA. meter, £1. U.S. Army handie-talkies with valves, less coils and X-tals, with case, £2, without case, 30/-. A.W.A. H6499, 6-volt vib. pack, £3. Vertical photo enlarger, condenser lenses, masking board, etc. Uses your own camera as proj. lens £5. **M. J. O'Brien, 181 Barkly St., Nth. Fitzroy, Melbourne. JW1897.**

SELL: Astronomical Telescope, 6in. diam. aluminised Pyrex mirror. £35 or best offer. **191 Edgecliff Rd., Woollahra.**

SELL: Plate Mod. Type 1 II, Mk. II. Input 6v vib. and 240v AC. No further use. Details **VK5BB, Crystal Brook, S.A.**

SELL: Type 3 Mk. II, new full kit spares. **D.C.A., 475 Collins St., Melbourne.**

SELL: Mags. R. & H. 1946-'50 comple A.R.W. 1944-47 complete, 27 cop 48-50. Amateur Radio. March, '46-Ap 50. Amateur Radio, Mar., '46-Apr., '48, miscellaneous mags. Any reasonable offe **13 Royal Pde., Mordialloc, S.12, Vic.**

SELL: 5-valve receiver (1K5, 19) 1e phones & batts., £5. R. & H. batte oscillator, party calibrated, less valve a batteries, £3. **A. Wrembeck, Glenc Gowrie Junct., Qld.**

SELL: Eddystone 640 with speaker, new, £55. **Gerald Radford, 2 Bogan S Summer Hill, N.S.W. UA3065.**

SELL: Test Panel as supplied by Rad College. Includes signal tracer, mul meter, five-band mod. oscillator, ran 150 K/c. to 26 M/c, £35. **Shennan, 8 Mose St., Strathfield.**

WANTED: 300w, 240v alternator. **Behenna, Crystal Brook, S.A.**

WANT: 3BZ Transmitter, any con **Write M. Black, George St., Liverpo**

WANTED Philips "B" Battery Elimin tor. Good condition. **P. Warrilow, Bright St., Ryde.**

WANTED TO BUY: Nov., 1934, Popul Mechanics American Magazine. **Flower, 163 Lawson St., Redfern.**

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